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## **Who Cares about the Weather?: Climate Change and U.S. National Security**

JOSHUA W. BUSBY

*Is climate change a national security threat to the United States? This question remains a subject of debate in academia and has received renewed emphasis in the policy community. Even taking a narrow definition of national security, climate change already constitutes a national security threat to the United States, both in terms of direct threats to the country as well as its broader extraterritorial interests. While some of these purported threats—abrupt climate change and sea-level rise—have been overstated by advocates, several concerns, mostly related to the effects of extreme weather events on the United States and its strategic interests overseas, are sufficient enough that they already constitute security threats. That climate change potentially poses a direct threat to the U.S. homeland and its overseas interests suggests the subject warrants serious attention.*

Is climate change a national security threat to the United States? This question remains a subject of debate in academia and has received renewed emphasis in the policy community.<sup>1</sup> Moves to link climate change and other

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<sup>1</sup> Environmental security gained some traction in the policy community in the 1990s. For example, the U.S. Department of Defense created a deputy undersecretary position for environmental security during

environmental issues to security date back to the late 1980s when scholars and advocates sought to widen the concept to encompass environmental concerns, health, human rights, and development.<sup>2</sup> These efforts to broaden the agenda, to “securitize” non-traditional harms, coalesced into the concept of “human security,” an expansive term that incorporates most non-military threats to human welfare.<sup>3</sup> The motives of advocates and some scholars to broaden security are similar. Security is regarded as a more potent hook to get the attention of political heavyweights. This is particularly true after September 11, 2001.

As Barry Buzan et al. note, issues acknowledged to be inside the security box—by virtue of their seriousness—warrant priority and may allow decision makers to pursue emergency measures outside the realm of normal politics.<sup>4</sup> The attraction of framing environmental problems as security issues is understandable, but some scholars have questioned this approach. Security may cease to mean anything if it means everything.<sup>5</sup> By using the security frame, the concept may be tied to militarized solutions that are inappropriate ways

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the Clinton administration. While this position was eliminated during the George W. Bush administration, some military-to-military training exercises in environmental security continued thereafter. Efforts to assess the security implications of climate change were initiated in 2006 and 2007. In March 2007, Senators Dick Durbin and Chuck Hagel introduced a bill requesting a National Intelligence Estimate to assess the national security implications of climate change. In April 2007, the CNA Corporation released a report overseen by retired generals to document the links between climate and national security. In that same month, the United Nations Security Council also hosted its first ever meeting on whether climate change constituted a threat to international peace and security. In November 2007, two Washington think tanks, the Center for Strategic and International Studies (CSIS) and the Center for a New American Security (CNAS), released another report on climate and security.

<sup>2</sup> See Lester Russell Brown, *Redefining National Security* (Washington, DC: Worldwatch Institute, 1977); Richard Ullman, “Redefining Security,” *International Security* 8, no. 1 (Summer 1983): 129–53; Jessica Tuchman Mathews, “Redefining Security,” *Foreign Affairs* 68, no. 2 (Spring 1989): 162–77; Norman Myers, “Environment and Security,” *Foreign Policy* no. 74 (Spring 1989): 23–41; Michael Renner and Worldwatch Institute, *National Security: The Economic and Environmental Dimensions* (Washington, DC: Worldwatch Institute, 1989); David A. Wirth, “Climate Chaos,” *Foreign Policy* no. 74 (Spring 1989): 3–22; Peter H. Gleick, “Environment and Security: The Clear Connections,” *Bulletin of the Atomic Scientists* 47, no. 3 (1991): 16–21; Ian Rowlands, “The Security Challenges of Global Environmental Change,” *The Washington Quarterly* 14, no. 1 (Winter 1991): 99–113; Edward A. Kolodziej, “Renaissance in Security Studies? Caveat Lector!” *International Studies Quarterly* 36, no. 4 (December 1992): 421–38; Marvin S. Soroos, “Global Change, Environmental Security, and the Prisoner’s Dilemma,” *Journal of Peace Research* 31, no. 3 (August 1994): 317–32; Geoffrey D. Dabelko and David D. Dabelko, *Environmental Security: Issues of Conflict and Redefinition* (Washington, DC: Woodrow Wilson Center, 1995); Stephen J. Del Rosso, “The Insecure State: Reflections on ‘The State’ and ‘Security’ in a Changing World,” *Daedalus* 124, no. 2 (Spring 1995): 175–207.

<sup>3</sup> United Nations Development Program, *New Dimensions in Human Security* (New York: Oxford University Press, 1994); Gary King and Christopher J. L. Murray, “Rethinking Human Security,” *Political Science Quarterly* 116, no. 4 (Winter 2001/2002): 585–610; Taylor Owen, “Human Security—Conflict, Critique and Consensus: Colloquium Remarks and a Proposal for a Threshold-Based Definition,” *Security Dialogue* 35, no. 3 (September 2004): 373–87.

<sup>4</sup> Barry Buzan, Ole Wæver, and Jaap de Wilde, *Security: A New Framework for Analysis* (Boulder: Lynne Rienner, 1998), 3.

<sup>5</sup> Daniel Deudney, “The Case Against Linking Environmental Degradation and National Security,” *Millennium* 19, no. 3 (1990): 461–76; Marc A. Levy, “Is the Environment a National Security Issue?” *International Security* 20, no. 2 (Autumn 1995): 35–62; Nils Petter Gleditsch, “Armed Conflict and the

of resolving the underlying issues or that divert attention from less nationalist problem-solving means.<sup>6</sup> Like environmental security, human security is also faulted for being polemical rather than a useful analytic construct.<sup>7</sup>

Scholars of environmental security have pursued research in keeping with conventional understandings of security by looking at the connections between environmental scarcity and conflict. A decade of scholarship focused on the relationship between environmental scarcity and violent conflict in developing countries.<sup>8</sup> This line of research highlighted the indirect but important role environmental degradation may play in worsening socio-economic conditions and giving rise to violence. However, in abandoning the normative and political justification that inspired early advocates of environmental security, the substantive agenda of the environment as a core foreign policy concern of great powers was largely left by the wayside.

Although a return to the definitional disputes of the 1990s could be a cul-de-sac, the study of environmentally inspired violent conflict is not the only direction for scholars interested in the environment and security. Even taking a narrow definition of national security, there are clearly ways in which climate change already constitutes a national security issue for the United States, both in terms of direct threats to the country as well as its broader extraterritorial interests. Some of these purported threats—abrupt climate change and sea-level rise—have been overstated by advocates, but several concerns, mostly related to the effects of extreme weather events on the United States and its strategic interests overseas, are of sufficient concern that they already constitute national security threats. That climate change potentially poses a direct threat to the U.S. homeland and its overseas interests suggests the subject warrants serious attention.

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Environment: A Critique of the Literature," *Journal of Peace Research* 35, no. 3 (1998): 381–400; Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton: Princeton University Press, 1999).

<sup>6</sup> Deudney, "The Case Against Linking Environmental Degradation and National Security"; Ole Waever, "Securitization and Desecuritization," in *On Security*, ed. Ronnie D. Lipschutz (New York: Columbia University Press, 1995), 46–86; Ken Conca, "The Environment-Security Trap," *Dissent* 45, no. 3 (Summer 1998): 40–45; Rodger A. Payne, "Persuasion, Frames and the Construction of International Norms: Evidence From the Climate Change Debate" (paper presented at the International Studies Association, May 1999).

<sup>7</sup> Stephen M. Walt, "The Renaissance of Security Studies," *International Studies Quarterly* 35, no. 2 (June 1991): 211–39.

<sup>8</sup> Thomas F. Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security* 16, no. 2 (Autumn 1991): 76–116; Thomas F. Homer-Dixon, "Environmental Scarcities and Violent Conflict: Evidence from Cases," *International Security* 19, no. 1 (Summer 1994): 5–40; Dabelko and Dabelko, *Environmental Security*; Thomas F. Homer-Dixon and Marc A. Levy, "Environment and Security," *International Security* 20, no. 3 (Winter 1995): 189–98; Nils Petter Gleditsch, *Conflict and the Environment* (Dordrecht, Holland; Boston: Kluwer Academic Publishers, 1997); Carsten F. Ronnfeldt, "Three Generations of Environment and Security Research," *Journal of Peace Research* 34, no. 4 (November 1997): 473–82; Colin H. Kahl, *States, Scarcity, and Civil Strife in the Developing World* (Princeton: Princeton University Press, 2006); Gunther Baechler and Kurt R. Spillmann, eds., *Environmental Degradation as a Cause of War* (Zurich: Verlag Ruediger, 1996). For more citations, contact the author.

The links between climate change and security are not just of interest to policy makers: they also have important implications for security studies as an academic pursuit. National security threats are typically understood as emanating from purposive human agents seeking to inflict damage on another country and its interests. If the argument here is right, then—even with a relatively conservative definition of national security—we have created space for harms that lack intentionality (like climate change and disease) to constitute national security threats. In so doing, this approach opens up the field of security studies to new concerns without having as expansive a definition as human security.<sup>9</sup>

This article also raises questions about how political scientists can write about the future. Climate change is a novel problem. Never before has humanity had the capability to alter the planet in such a fundamental way. This makes empirical scholarship difficult. Little political science research is predictive; most research seeks to explain past events from which we may infer something about the future.<sup>10</sup> These inter-temporal inferences, however, may be invalid if the future is likely to be different from the past. How can political science talk about future problems without falling into mere speculation? Given the novelty of this problem and the uncertainty surrounding possible effects, it is hard to extrapolate from the physical effects of climate change to the likely political effects. The risk of making sweeping claims about the potential effects of climate change is two-fold: non-falsifiability and excessive alarmism. As one scholar noted:

Environmental organizations and other advocacy movements are prone to argue that we are now at a turning point in human history . . . In saying this, one may easily slip into prophesy. ‘There will be water wars in the future’ is no more a testable statement than the proverbial ‘The End of the World is at Hand,’ unless terms such as ‘the future’ and ‘at hand’ are clearly specified.<sup>11</sup>

This article focuses on the physical effects of climate change that scientists believe are “likely.”<sup>12</sup> From these likely effects, we can extrapolate

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<sup>9</sup> For critiques of human security, see Roland Paris, “Human Security: Paradigm Shift or Hot Air?” *International Security* 26, no. 2 (Fall 2001): 87–102; Barry Buzan, “A Reductionist, Idealistic Notion that Adds Little Analytical Value,” *Security Dialogue* 35, no. 3 (September 2004): 369–70; Roland Paris, “Still an Inscrutable Concept,” *Security Dialogue* 35, no. 3 (September 2004): 370–72.

<sup>10</sup> For a similar discussion, see Nils Petter Gleditsch, Ragnhild Nordås, and Idean Salehyan, “Climate Change and Conflict: The Migration Link” (Coping with Crisis Working Paper Series of the International Peace Academy, New York, May 2007), <http://www.ipacademy.org/our-work/coping-with-crisis/working-papers> (accessed 25 May 2008).

<sup>11</sup> Nils Petter Gleditsch, “Armed Conflict and the Environment: A Critique of the Literature,” *Journal of Peace Research* 35, no. 3 (1998): 394. For similar works, see Norman Myers, *Ultimate Security: The Environmental Basis of Political Stability* (New York: W.W. Norton, 1993); Paul Roberts, *The End of Oil: On the Edge of a Perilous New World* (Boston: Houghton Mifflin, 2004).

<sup>12</sup> The Intergovernmental Panel on Climate Change (IPCC) has developed specific language to describe the probability of different potential outcomes associated with climate change. At the upper end are

a number, if not exhaustive set, of plausible national security implications in a manner that is theoretically informed. Scientific uncertainty about the effects of climate change increases the further out into the future and the more far-reaching and complex the potential consequences. A focus on more bounded, short-run climate effects allows us to identify the potential security consequences that can be tested empirically. For example, if climate change is likely to lead to more variable precipitation, we can test, as Marc Levy et al. have done, whether or not rainfall volatility has historically been correlated with a higher incidence of violent conflict.<sup>13</sup>

By focusing on processes that are reasonably well understood, the article may have a conservative bias and understate the gravity of the threat. For example, scholars like Thomas Homer-Dixon worry that non-linear effects and feedback mechanisms may make the problem of climate change worse than characterized here. With complex interdependence between countries and between systems, Homer-Dixon warns of “synchronous failures.” He worries climate change will come together with other economic, environmental, and demographic stresses with consequences so severe that they collectively precipitate broader economic and social breakdown.<sup>14</sup> With, however, the national security effects of climate change contentious in both academia and the policy world, a restrained approach makes a significant contribution—even with a narrow definition of national security and an emphasis on most likely effects, climate change already poses a national security risk to the United States.

The article is divided into five sections. In the first section, I expand on the rationale for focusing on likely effects. I develop in the second section an analytical framework by which we can understand what constitute potential national security risks stemming from climate change, including direct effects on the homeland and threats to a country’s overseas interests. Next I evaluate the direct effects of climate change on the territorial United

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outcomes it believes are “virtually certain,” those that have a greater than 99 percent probability of occurrence. From there, it identifies “extremely likely” as greater than 95 percent probability, “very likely” as greater than 90 percent, “likely” as greater than 66 percent, “more likely than not” as greater than 50 percent, “unlikely” as less than 33 percent, “very unlikely” as less than 10 percent, and “extremely unlikely” as less than 5 percent. In the 2001 Third Assessment Report, the IPCC concluded that the human contribution to climate change was “likely.” In the 2007 Working Group I contribution to the Fourth Assessment Report, the human contribution was upgraded to “very likely.” See IPCC, “Technical Summary,” *Climate Change 2007: The Physical Science Basis*, Contribution of Working Group I to the Fourth Assessment Report of the IPCC (New York: Cambridge University Press, April 2007), <http://www.ipcc.ch/ipccreports/ar4-wg1.htm> (accessed 27 May 2008).

<sup>13</sup> Marc A. Levy et al., “Freshwater Availability Anomalies and Outbreak of Internal War: Results from a Global Spatial Time Series Analysis” (paper presented at the Human Security and Climate Change, Oslo, Norway, November 2005), <http://www.ciesin.columbia.edu/pdf/waterconflict.pdf> (accessed 20 July 2008).

<sup>14</sup> Thomas F. Homer-Dixon, *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization* (Washington, DC: Island Press, 2006). For a more optimistic assessment, see John McNeill, “Diamond in the Rough: Is There a Genuine Environmental Threat to Security?” *International Security* 30, no. 1 (Summer 2005): 178-95.

States by looking at four areas: (1) abrupt climate change, (2) sea-level rise, (3) extreme weather events, and (4) Arctic ice melt. In the fourth section, I consider the effects of climate change on the country's extraterritorial interests including U.S. overseas assets and the links between (1) climate change and violent conflict, (2) state failure, and (3) humanitarian disasters. Finally, I discuss the policy implications of the analysis in the preceding sections.

#### ON TIME HORIZONS, UNCERTAINTY, AND THE LIKELY EFFECTS OF CLIMATE CHANGE

To claim that an issue is or prospectively will be a national security threat implies that the effects of climate change will become manifest in a period of time about which decision makers care. U.S. policy makers seem to need high certainty that the problem of climate change is real, severe, and amenable to public action. Policy makers seem more concerned about false alarms, so-called "Type I" errors, than they are in not taking action when they should have. As Andrew Dessler writes, "The 'scientific uncertainty' argument is not about science at all, but about a judgment about whether it is worse to under or overreact to climate change."<sup>15</sup>

The issue of uncertainty looms large in the climate debate because many of the effects will occur far in the future. Possible effects become more severe and yet more uncertain the further out in time. Based on how U.S. policy makers have responded to the variety of warnings from the scientific community about climate change, their time horizons appear too short to allow them to focus on a distant problem of unknown probability, even one that could have potentially catastrophic effects.<sup>16</sup>

Even U.S. government institutions that plan for long-run contingencies only look out twenty to thirty years into the future.<sup>17</sup> Problems that may potentially become severe in seventy-five years are unlikely to command the attention of U.S. policy makers besieged by immediate concerns. The short-time horizons of decision makers pose a tough test for those seeking to make the case that climate change is a national security risk. If it can be demonstrated that even within a short period of time climate change threatens U.S. national security, then the argument presented here is on even stronger ground. While policy makers' preoccupation with climate change may be

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<sup>15</sup> Andrew Dessler, "Uncertainty," (Boulder: University of Colorado Prometheus Weblog, 13 February 2006), [http://sciencepolicy.colorado.edu/prometheus/archives/climate\\_change/000717andrew\\_dessler\\_on\\_un.html](http://sciencepolicy.colorado.edu/prometheus/archives/climate_change/000717andrew_dessler_on_un.html) (accessed 21 February 2007).

<sup>16</sup> See Paul Pierson, *Politics in Time: History, Institutions, and Social Analysis* (Princeton: Princeton University Press, 2004), 41–42.

<sup>17</sup> The National Intelligence Council (NIC), for example, in 2004 published the NIC 2020 report on future threats. The Quadrennial Defense Review report that is prepared every four years looks out twenty years.

**TABLE 1** Summary of Expected Effects in IPCC 2007 Working Group I Report

Phenomenon and Direction of Trend	21st Century Likelihood
Warmer and fewer cold days and nights, warmer and more frequent hot days and nights occur over most land areas.	Virtually certain
Warm-spell and heat-wave frequencies increase over most land areas.	Very likely
Heavy precipitation events increase over most areas.	Very likely
Areas affected by drought increase.	Likely
Intense tropical cyclone activity increases.	Likely
Incidences of extremely high sea levels (excluding tsunamis) increase.	Likely

shifting as the effects become manifest, policy makers are still likely to be most responsive to consequences of climate change for which the scientific evidence is already compelling. This article therefore focuses on aspects of the climate problem that scientists already deem likely to emerge in the time horizon policy makers care about.

A 2007 Working Group report by the Intergovernmental Panel on Climate Change (IPCC) summarizes these effects by kind, likelihood, and impact on different sectors such as agriculture and human health (see Table 1). The main conclusion is that “confidence has increased that some weather events and extremes will become more frequent, more widespread and/or more intense during the 21st century.”<sup>18</sup>

Not only does the IPCC consider the potential sectoral effects of climate change, it also summarizes likely regional effects. Some areas (in Northern Europe, Russia, and the Arctic) may experience some positive effects of a warming climate in the short run, but long-run net consequences for all regions are likely to be negative. A number of regions, namely Africa and parts of Asia, are particularly vulnerable, given their geographic location and their limited governmental capacities to respond to flooding, droughts, and declining food production. Even the United States will face a number of negative consequences from droughts, heat waves, and storms.<sup>19</sup>

## THEORIES OF NATIONAL SECURITY AND CLIMATE CHANGE

National security has historically “meant protection from organized violence caused by armed foreigners.”<sup>20</sup> While national security traditionally refers to protecting the state’s territorial integrity, it has a broader meaning than state

<sup>18</sup> All are likely continuations of trends already observed at the end of the twentieth century. See IPCC, *Climate Change 2007: The Physical Science Basis*.

<sup>19</sup> IPCC, “Regional Climate Projections,” *Climate Change 2007: The Physical Science Basis*, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4/wg1/ar4-wg1-chapter11.pdf> (accessed 8 July 2007).

<sup>20</sup> The term “national security” was purportedly coined in the 1940s by James Forrestal, FDR’s secretary of the navy. Del Rosso, “The Insecure State,” 183.

survival.<sup>21</sup> Great powers like the United States have interests beyond their borders for which they may be willing to fight. These vital interests may be tied to the country's way of life and regarded as so important that a threat to them could be considered a challenge to national security.<sup>22</sup>

National security is often identified with the means of violence.<sup>23</sup> Policy tools other than the use of force, however, could potentially better serve security goals. As Edward Kolodziej notes, America's containment strategy for the Soviet Union was also built on support for "free governments and markets."<sup>24</sup> We can see the limits of thinking about strategy in primarily military terms by looking at the costly U.S. occupation of Iraq that, by all accounts, initially was focused on toppling Saddam Hussein's government and paid less attention to Phase IV post-combat operations.

With interstate war less common and internal violent challenges becoming more important threats to state integrity, the discussion of state security being confined to external challenges makes less sense. Transnational terrorism also suggests non-state actors can pose national security threats. Were the events of September 11, 2001 only a security concern because foreign agents carried them out? Are agency and intentionality required for a problem to constitute a national security threat? The characteristics of the attack—its suddenness, the large-scale loss of life, the impairment of the country's critical infrastructure, and the need for military mobilization to prevent mass hysteria—are perhaps more important than whether outside agents were responsible. Some natural world phenomena, in their speed and level of intensity, could bring about results that resemble those wrought by armed external attack and trigger a similar kind of crisis response. In this view, direct national security threats encompass those extraordinary harms that can swiftly kill or endanger large numbers of people and cause such large-scale disruption that local public health, law enforcement, and emergency response agencies cannot contain the threat.<sup>25</sup>

What kinds of climate change effects could trigger such a situation? At the extreme end, a state ceasing to exist as an independent unit would be the worst consequence. Some island nations might be so vulnerable to climate change that they become virtually uninhabitable. Even if a country is too

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<sup>21</sup> Robert J. Art, *A Grand Strategy for America* (Ithaca: Cornell University Press, 2003), 3. Protecting the nation's access to oil resources is an important national objective for which the United States (and countries like Japan) historically has been prepared to wage war.

<sup>22</sup> This was explicitly the Carter Doctrine which announced U.S. willingness to defend interests in the Persian Gulf through military means.

<sup>23</sup> Walt, "The Renaissance of Security Studies," 21.

<sup>24</sup> Kolodziej, "Renaissance in Security Studies?" 428.

<sup>25</sup> This definition accords with that in Levy, "Is the Environment a National Security Issue?" 43; King and Murray, "Rethinking Human Security," 594. For a critique, see Paris, "Human Security: Paradigm Shift or Hot Air?" Another more expansive view sees national security threats as "problems that may cause extraordinary damage to the nation." Peter Bergen and Laurie Garrett, *Report of the Working Group on State Security and Transnational Threats* (report prepared for the Princeton Project on National Security, 2006), <http://www.princeton.edu/~ppns/conferences/reports/fall/SSTT.pdf> (accessed 24 August 2006).

large to be vulnerable to destruction, its seat of government could be decapitated; physical threats to the seat of government itself are sometimes taken as a proxy of threats to the nation. For example, a badly located capital (such as Dhaka, Bangladesh) could be vulnerable from sea-level surges following storms. A storm-damaged capital might lack basic services—electricity, transport, and water—making it difficult for officials to report for work.

Even if the seat of government is unthreatened, the effects of natural world phenomena on the people may, when coupled with other triggers, do more to destabilize the government than an armed attack on the nation or its capital. A government that was unable or unwilling to respond to an extreme weather event or some epidemic might find itself unable to extend its monopoly on the use of force over its entire territory and challenged by armed rivals seeking to take advantage of the legitimation gap wrought by the state's failure to respond. Those rivals could use the grievance of the failure to recruit supporters for acts of armed rebellion.<sup>26</sup> Climate change, if it were to lead to an extreme weather event such as a heat wave or hurricane, could create the conditions for such a large-scale legitimation failure. The government, as the Sudanese did in Darfur, might also take advantage of latent tensions in that situation to foment unrest among different groups.<sup>27</sup> We might also observe a humanitarian crisis involving large-scale numbers of people that a government is either unable or unwilling to help.<sup>28</sup> We might also imagine that a weather event associated with climate change might damage a nation's critical infrastructure (fuel refineries, electricity, water, sewage, military installations) in ways that potentially put large numbers of people at risk, contribute to a government's credibility problem, or threaten to seriously undermine the country's economy.<sup>29</sup> In that instance, military assets might be diverted for homeland humanitarian relief, taking them away from other tasks relevant to external security.

Countries may also have their national security affected by the spillover from neighbors. For example, if violence erupts in a neighboring state, refugees may cross the border, as they have between Sudan and Chad. This, in turn, may upset the demographic and political balance in the recipient country, as new arrivals potentially compete for resources with the existing population. Refugees may also, if they join with co-ethnics, destabilize the

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<sup>26</sup> Kahl discusses this in terms of the "deprivation" hypothesis. Colin Kahl, "Demographic change, Natural Resources and Violence: The Current Debate," *Journal of International Affairs* 56, no. 1 (Fall 2002): 261–63.

<sup>27</sup> Kahl writes of how the Moi government in Kenya used emergent land scarcities to encourage armed violence against political rivals. Colin Kahl, "Population Growth, Environmental Degradation, and State-Sponsored Violence: The Case of Kenya, 1991–93," *International Security* 23, no. 2 (Fall 1998): 110–12.

<sup>28</sup> Nigel Purvis and Joshua Busby, "The Security Implications of Climate Change For The UN System" (submission to the United Nations High-Level Panel on Threats, Challenges, and Change, Woodrow Wilson International Center for Scholars, Washington, DC, 2004), [http://www.wilsoncenter.org/topics/pubs/ecspr10\\_unf-purbus.pdf](http://www.wilsoncenter.org/topics/pubs/ecspr10_unf-purbus.pdf) (accessed 10 April 2007).

<sup>29</sup> The author thanks Troy White for this point.

country if they launch cross-border attacks or if other groups in the recipient country worry about ethnic favoritism for the new arrivals.<sup>30</sup> One could imagine that persistent drought conditions or a hurricane could spur large numbers of people to cross borders in this way, requiring military mobilization to contain the population movement or provide essential services. To the extent that climate change is identified as potentially increasing the number or severity of extreme weather events, it would be implicated in these kinds of refugee crises. Finally, border disputes over territory and waters historically have been a major contributor to interstate disputes. A number of effects of climate change, such as extreme weather events or melting sea ice, could alter the territorial boundaries or waterways between states. In particular, melting of sea ice might open up previously inaccessible areas to transportation or to oil and gas exploration, potentially contributing to interstate competition over sovereign control of a territory and its natural resources.

In order for climate change to constitute a direct threat a country, at least one of the following conditions must be met (see Table 2).

**TABLE 2** Criteria for Direct Threat to Homeland

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Does climate change pose a threat to the homeland?	<ol style="list-style-type: none"> <li>1. Climate change threatens the existence of the country.</li> <li>2. Climate change could decapitate the seat of government.</li> <li>3. Climate change threatens the country's monopoly on the use of force.</li> <li>4. Climate change could disrupt or destroy critical infrastructure.</li> <li>5. Climate change could lead to such catastrophic short-run loss of life or general well-being as to undermine the government's legitimacy.</li> <li>6. Climate change could cause these effects on neighbors to spur refugee crises.</li> <li>7. Climate change could alter the territorial borders or waters of the country.</li> </ol>
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Even if a country is not affected directly by climate change, it may feel its own national security is threatened by the effects of climate change on another country or region. Under what conditions might this occur? The region would have to be strategically significant in some way. A number of conditions would elevate a distant country's strategic importance. I have identified a list, though not exhaustive, of different conditions that would plausibly inspire extraterritorial concern. Here I make specific reference to the United States, but the conditions could be applied to other countries that have regional (if not global) interests and reach.

First, countries typically are most worried about their own overseas military installations, embassies, and citizens. Because these diplomatic facilities and military installations are like extensions of the national territory, they take on more importance than their inherent strategic significance. A country's

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<sup>30</sup> Kahl calls this strategic use of scarcity "state exploitation." Kahl, *States, Scarcity, and Civil Strife*, 26.

military would likely be called in to rescue government employees and citizens in the event of a weather emergency overseas. Climate change could have more strategic significance by threatening key overseas military installations and therefore impair the country's power projection internationally.

Aside from this more parochial interest, countries may be concerned about the broader security consequences of climate change on others. Those effects could be so large that they harm countries regarded as allies or crucial partners in a shared security venture, resulting in a disruption or impairment in security cooperation. The ally could find its stability threatened by climate change, requiring it to divert military resources from joint international efforts to contain domestic disorder. At an extreme, countries might be called upon to assist their allies in delivering emergency aid or containing disorder.

Climate change could also affect key nodes in the global economy with consequences so severe they might resemble the sort of supply and price disruptions experienced during the 1970s oil crisis. If a climate event could do damage on the scale of Katrina or the World Trade Center to an economically important location, other countries would be worried about the knock-on consequences for their economies and the potential need for economic or military intervention to stabilize markets and vulnerable places after the fact. Climate change, particularly through the effects of storms on key port cities or straits, could threaten important nodes, such as Shanghai, in the global economy. Relatedly, a country with important natural resource assets like petroleum-rich Nigeria could be vulnerable to the destabilizing effects of drought and other climate effects that, in turn, might have negative spillovers on the country's exports through damage to pipelines, ports, etc.

The home country would be concerned about the effects of climate change on other countries that are perhaps less economically important to the global economy but where climate change-induced instability could lead to contagion or blowback. For example, a country like Indonesia could be buffeted by an extreme weather event, and the United States would be concerned for multiple reasons, including that the country with the largest Muslim population could become vulnerable to extremism (as well as uncertainties about an ally, sea-lanes, and access to oil).<sup>31</sup>

Finally, a country with a large diaspora population might have special affinity if the former home nation were to experience severe effects of climate change. For example, if Cuba or Haiti were to experience an extreme weather disaster, Cuban- and Haitian-Americans would likely press the U.S. government for a robust response. While this might not make those countries strategic in a traditional sense, it would be negligent for officials to fail to plan for a disaster that would inevitably draw in the United States.

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<sup>31</sup> Indonesia, for example, is cited by a study by Marc Levy et al. as one of the world's countries most vulnerable to both climate and political risk. Marc A Levy et al., "Assessment of Select Climate Change Impacts on U.S. National Security" (working paper of the Center for International Earth Science Information Network (CIESIN), Columbia University, 1 July 2008), [http://www.ciesin.columbia.edu/documents/Climate\\_Security\\_CIESIN\\_July\\_2008\\_v1\\_0\\_ed.pdf](http://www.ciesin.columbia.edu/documents/Climate_Security_CIESIN_July_2008_v1_0_ed.pdf) (access 20 July 2008).

**TABLE 3** Criteria for Strategic Importance

Is the region strategically significant?	<ol style="list-style-type: none"> <li>1. The area is a location for an at-risk diplomatic mission, military base, or where a significant number of a country's own expatriates live.</li> <li>2. The country is an ally in an important geostrategic mission.</li> <li>3. The area is a conduit for transport of goods or military assets.</li> <li>4. The region is a source of economically or militarily significant natural resources.</li> <li>5. The country is located in a politically sensitive region where instability could lead to contagion or blowback on the homeland.</li> <li>6. The country is the original home of a large diaspora population.</li> </ol>
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Thus, in order for a country or region to qualify as one of high strategic importance, at least one (and possibly more) of the following conditions must be met (see Table 3).

For the final five conditions, however, where the country's own overseas assets are not threatened, other criteria would have to exist for the home country to feel threatened by these developments. In addition to geostrategic significance, the stakes involved must be high. A problem that is likely to remain internal to a country and not threaten the regime or the wider region has lower stakes than a conflict that potentially threatens to bring down the government or create broader cross-border disputes. The imminence of the threat, harkening back to the discussion in the first section, also has a bearing on the stakes. Threats that are likely to occur in the coming months or calendar year are going to be of more immediate concern to policy makers than those with long time horizons. Climate change is often implicated in glacier melting, as what appears to be taking place on the slopes of Mt. Kilimanjaro in Tanzania.<sup>32</sup> That glacier provides water for much of the surrounding region. Its diminishment or disappearance could set in motion water shortages that then contribute to resource scarcity-related conflicts. This, however, is something of a slow-motion tragedy. Thus, it would be harder to justify to policy makers thousands of miles removed that this problem carries the same urgency as more imminent dangers. An extreme weather event, however, presents the kind of short-term shock and destabilizing effects that could generate interest from afar. Another consideration involves the number of people potentially affected by a crisis. If the number is small (in the hundreds or thousands), then, all else equal, a distant country would be less likely to feel that these developments will reach a threshold beyond which those effects could spillover, either regionally or transnationally. Moreover, aside from the strategic implications, such crises are more likely to engender humanitarian concern among domestic populations of distant countries when

<sup>32</sup> IPCC, "Africa," *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to Fourth Assessment Report of the IPCC (New York: Cambridge University Press, April 2007), <http://www.ipcc-wg2.org/> (accessed 19 July 2007).

the scale is identified as “large.” By large scale, tens of thousands of potential victims seem a reasonable threshold that could command either strategic or humanitarian concern.<sup>33</sup> Before threats become imminent, assessing the stakes is harder, but analysts can rely on scientific evidence about physical vulnerability and indicators of political risk such as past history of conflict, inequality, and other well-known causes of internal conflict.

In order for an issue to be judged as one involving high stakes, at least one (and possibly two) of the following questions must be answered “yes” (see Table 4).

**TABLE 4** Criteria for High-Stakes International Crises

Does the issue involve high stakes?	<ol style="list-style-type: none"> <li>1. The conflict threatens the regime.</li> <li>2. The conflict potentially may spillover across borders.</li> <li>3. The threat is imminent.</li> <li>4. The conflict potentially endangers the lives of tens of thousands.<sup>34</sup></li> </ol>
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Both attributes—strategic significance and scale—can take on either a high or low value, giving us four potential configurations (see Table 5).

**TABLE 5** Matrix for Extraterritorial Threat Assessment

Strategic Importance	Stakes		
High Strategic Importance	Monitoring Situation (1)	Strategic Threat (2)	High
Low Strategic Importance	Minor (3)	Moral Challenge (4)	↓ Low
	Low stakes ←————→	High stakes	

In Figure 5, strategic threats are most likely cases where a state’s leaders will feel threatened by distant events. Minor cases are the least likely to engender foreign interest. Moving left to right, the stakes become higher. Moving south to north, the strategic significance of the region increases. Moral challenges are interesting cases where the stakes appear to be high, but the region lacks strategic significance. This typology can be useful in assessing the seriousness of specific threats once they emerge. In addition to direct threats to a state, climate change therefore potentially poses an extraterritorial threat to a country’s interests if a strategically important region faces a high-stakes threat.

<sup>33</sup> Whether or not ten thousand or more is large enough to induce attention could be tested empirically using opinion polls or records of past conflict casualty totals. One proxy for large-scale loss of life could be the number of refugees or internally displaced persons.

<sup>34</sup> Bergen and Garrett discuss similar criteria including the threat’s scale of material and psychological impact, its speed and mobility, potential duration, and the adequacy and sustainability of response capabilities. Bergen and Garrett, *Report of the Working Group on State Security*, 12–13.

## THE TERRITORIAL EFFECTS OF CLIMATE CHANGE ON THE UNITED STATES

To constitute a direct threat to U.S. national security, the effects of climate change would have to threaten the country's existence, its capital, its monopoly on force, its critical infrastructure, or its broader legitimacy; create refugees; or alter the country's territorial borders (including waterways).

Four proposed consequences of climate change potentially could impose these kinds of effects on the United States: (1) abrupt climate change, (2) rising sea levels, (3) extreme weather events, and (4) Arctic sea ice melt. Scientific uncertainty about abrupt climate change and the limited projected physical effects of rising sea levels before the latter part of the twenty-first century lead me to conclude that neither as yet constitutes a security threat for the United States. However, rising scientific concern about extreme weather events (hurricanes in particular) and Arctic summer sea ice melt are already sufficiently credible to warrant attention of security scholars and practitioners.

### Abrupt Climate Change

Futurists Peter Schwartz and Doug Randall in a widely cited 2003 paper commissioned by the Pentagon wrote about the consequences of abrupt climate change for U.S. national security. They conjured a scenario of "thermohaline collapse" beginning in 2010, precipitating a disruption in the flow of warm waters of the Gulf Stream that leads to a decline in temperature by more than five degrees Fahrenheit in North America and Europe.<sup>35</sup>

Until the late 1990s, climate change was thought to occur slowly over hundreds and thousands of years, thus giving human populations time to adapt. Scientists subsequently found significant evidence in the historical record that sharp changes in rainfall and temperature are possible over shorter periods of time, in as little as a few decades.<sup>36</sup> Rising concentrations of greenhouse gases may set in motion large-scale abrupt changes that could alter the possibilities for human habitation over large parts of the globe. Among the most worrisome consequences is a potential slowdown or collapse of thermohaline circulation (THC) of ocean currents, also referred to as meridional overturning circulation (MOC). The Gulf Stream carries tropical warm water to the North Atlantic, contributing to more clement winter weather in Europe. Typically, water in the Gulf Stream becomes more dense as it loses its heat and becomes more saline from evaporation. By the time it reaches Europe, it is sufficiently dense to sink and then join the underwater conveyor back across the Atlantic to resurface later once warmed for the return trip. If that cooling salt water traveling across the Atlantic becomes

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<sup>35</sup> Peter Schwartz and Doug Randall, *An Abrupt Climate Change Scenario and Its Implications for United States National Security* (Emeryville, CA: Global Business Network, 2003).

<sup>36</sup> For an accessible account, see Eugene Linden, *The Winds of Change: Climate, Weather, and the Destruction of Civilizations* (New York: Simon & Schuster, 2005).

too cool from increased ice-melt and rainfall, the water would stop sinking, and the conveyor could slow down, potentially setting off another ice age, with European temperatures most likely to plummet. A number of studies in recent years have found some preliminary evidence of a slow-down.<sup>37</sup>

Scientists do not understand these processes very well. They also believe these kinds of events are of low probability in the coming century. As the IPCC's 2001 Third Assessment concludes, "The likelihood of many of these changes in Earth systems is not well-known, but is probably very low; however, their likelihood is expected to increase with the rate, magnitude, and duration of climate change."<sup>38</sup> Six years later, understanding remained patchy. Working Group I to the 2007 IPCC Fourth Assessment report concludes that meridional overturning circulation (MOC) of the Atlantic Ocean will very likely slow down during the twenty-first century but that it is very unlikely the MOC will "undergo a large abrupt transition during the 21st century."<sup>39</sup>

The Schwartz paper, despite the imprimatur of the Pentagon and scientific basis, had more in common with the disaster movie, *The Day After Tomorrow*. Given the state of the science on abrupt climate change, the report's discussion of scenarios is too alarmist and ultimately a distraction from the severe effects of climate change that scientists already believe are occurring. As paleoclimatologist Wallace Broecker writes, "As the one who first pointed out the link between the Atlantic's conveyor circulation and abrupt climate changes, I take serious issue with both the timing and the severity of changes proposed in the Pentagon scenario."<sup>40</sup> This is an area of climate science where it is fair to say we need more information.

### Rising Sea Levels

One of the most provocative scenes in Al Gore's documentary *An Inconvenient Truth* shows images of the potential effects of sea-level rise on major populated areas around the world. Gore suggests that global warming might cause either the West Antarctic ice shelf or Greenland to melt or break up and slip into the sea. The consequence, he argues, would be a rise in sea levels by twenty feet, leaving parts of San Francisco, New York, Beijing, Shanghai, and Calcutta, among other coastal areas, under water and displacing hundreds of millions.<sup>41</sup> Leaving aside the catastrophic international effects, the

<sup>37</sup> Wallace S. Broecker, "Thermohaline Circulation, the Achilles Heel of Our Climate System: Will Man-Made CO<sub>2</sub> Upset the Current Balance?" *Science* 278, no. 5343 (28 November 1997): 1582–88; Ruth Curry, Bob Dickson, and Igor Yashayaev, "A Change in the Freshwater Balance of the Atlantic Ocean over the Past Four Decades," *Nature* 426, no. 6968 (18–25 December 2003): 826–29.

<sup>38</sup> IPCC, "The Potential for Large-Scale and Possibly Irreversible Impacts Poses Risks That Have Yet to be Reliably Quantified," *Climate Change 2001: Impacts, Adaptation and Vulnerability*, [http://www.grida.no/climate/ipcc\\_tar/wg2/009.htm](http://www.grida.no/climate/ipcc_tar/wg2/009.htm) (accessed 8 April 2007).

<sup>39</sup> IPCC, "Summary for Policymakers," *Climate Change 2007: The Physical Science Basis*, 16, [http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1\\_Print\\_SPM.pdf](http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_SPM.pdf) (accessed 22 May 2008).

<sup>40</sup> Wallace Broecker, "Future Global Warming Scenarios," *Science* 304, no. 5669 (16 April 2004): 388.

<sup>41</sup> Albert Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It* (Emmaus, PA: Rodale Press, 2006), 198–208.

forced exodus of millions from New York and other low-lying American cities would clearly constitute unacceptable damage to the homeland and, if anything like Katrina, would require mobilization of the military to handle the humanitarian crisis.

Is a twenty-foot sea-level rise probable or potentially imminent? Gore does not spell out how quickly this process would occur, nor is he clear how likely this problem might be. Estimates of sea-level rise as a consequence of thermal expansion of the seas and glacier melt suggest only modest increases in sea level by 2080 or 2100. A 2004 study suggested that the estimates of mean global sea-level rise by 2080 range from twenty-five to thirty-seven centimeters. By 2050 the estimated number of additional people made vulnerable to flooding as a consequence of rising sea levels range from five to sixteen million. Not until 2080 do any of the estimates rise to above fifty million additional vulnerable people. These high-end estimates are based on no change in coastal protection.<sup>42</sup>

The 2007 IPCC Working Group I projections also suggest only modest sea-level rise by the end of the twenty-first century; across all emissions scenarios, the projections for the period 2090–99 compared to 1980–99 range from 0.18 meters to 0.59 meters. The report acknowledges these estimates do not include more dramatic changes to the Greenland or Antarctic ice sheets. If ice mass losses to Greenland are “sustained for millennia,” the report concludes this could eliminate the Greenland ice sheet and increase sea levels by seven meters. However, while there are some hints of more dynamic changes in ice sheets that could lead to greater sea-level rise, the IPCC concludes, “understanding of these processes is limited and there is no consensus on their magnitude.”<sup>43</sup>

Models of rising seas suggest the problem between now and 2100 is not especially serious, but they are not particularly good at capturing the already observed changes in glacier melt. Namely, they have difficulty explaining the sudden collapse of the Larson B Antarctic ice shelf between 1998 and 2002.<sup>44</sup> Gore’s projection is ultimately based on analogs from one hundred twenty thousand years ago when the earth was one degree warmer. Gavin Schmidt, a NASA scientist sympathetic to Gore’s movie, suggests that a twenty-foot increase in sea levels might unfold over one thousand years.<sup>45</sup> We really do not know what will happen. Thus, while the uncertainties associated with glacier melt deserve more investigation, this is not yet the core climate-related security challenge that we might think from media coverage.

<sup>42</sup> Robert J. Nicholls, “Coastal flooding and Wetland Loss in the 21st Century: Changes Under the SRES Climate and Socio-Economic Scenarios,” *Global Environmental Change* 14, no. 1 (2004): 79.

<sup>43</sup> IPCC, “Summary for Policymakers,” *Climate Change 2007: The Physical Science Basis*, 17.

<sup>44</sup> Michael Oppenheimer, “Ice Sheets and Sea Level Rise: Model Failure is the Key Issue” (commentary on Real Climate Weblog, 26 June 2006), <http://www.realclimate.org/index.php/archives/2006/06/ice-sheets-and-sea-level-rise-model-failure-is-the-key-issue/#more-315> (accessed 15 February 2007).

<sup>45</sup> Katharine Mieszkowski, “Did Al Get the Science Right?” *Spiegel Online*, 21 July 2006, <http://www.spiegel.de/international/1,1518,427655,00.html> (accessed February 2007). See also Richard A. Kerr, “A Worrying Trend of Less Ice, Higher Sea,” *Science* 311, no. 5768 (24 March 2006): 1698–701.

## Extreme Weather Events

Merely looking at the average level of sea-level rise misses two important aspects. First, there will be considerable variation. Some places, due to local geographic and geologic features, will experience higher sea-level rise than others in the next decades. Moreover, low-lying coastal areas, including New York City and southern Florida, will be subject to more frequent storm surges with extreme weather events, making the possibility for flooding and the need for emergency evacuation more urgent. Gradually rising sea levels coupled with extreme weather events thus pose a more pressing problem than sea-level rise on its own.

Until Hurricanes Katrina and Rita of 2005, most scholars believed that adaptive capabilities would in the short run insulate the United States from the worst effects of climate change.<sup>46</sup> The intensity of those hurricanes—more than any other event since the hot summer of 1988—put climate change on the radar of the U.S. policy community. Katrina was unprecedented in modern history. The storm destroyed much of New Orleans, caused more than \$80 billion in damages, killed more than one thousand eight hundred, and displaced more than two hundred seventy thousand people. Could the severity be related to climate change?

Scientists would not attribute a single event to climate change, but they might say climate change will make extreme storms like Katrina more likely. Among the hypothesized effects of climate change are the increased frequency and intensity of extreme weather events including hurricanes and days of extremely hot temperatures.<sup>47</sup> Several recent studies make these claims more plausible. A 2004 study by the United Kingdom's Hadley Centre on the European heat waves of 2003 (which contributed to the deaths of more than seventy thousand people<sup>48</sup>) found that human activity from greenhouse gas emissions has likely doubled the risk of heat waves of that magnitude.<sup>49</sup> With respect to hurricanes, both assertions, that climate change will increase their frequency and severity, are still debated, but there is more evidence to support the claim that climate change is contributing to the increased intensity of tropical storms. In the aftermath of Hurricane Katrina, the connection between hurricane intensity and climate change has become “perhaps the most hotly contested question in the scientific debate over climate

<sup>46</sup> Homer-Dixon and Levy, “Environment and Security”; Levy, “Is the Environment a National Security Issue?” 189.

<sup>47</sup> IPCC, *Climate Change 2001: Impacts, Adaptation and Vulnerability*, [http://www.grida.no/climate/ipcc\\_tar/wg2/310.htm#7222](http://www.grida.no/climate/ipcc_tar/wg2/310.htm#7222) (accessed 1 February 2007).

<sup>48</sup> The International Disaster Database reported more than 71,807 deaths due to extreme temperature in Europe in 2003, including the following country totals: Belgium (1,175), France (19,490), Germany (9,355), Italy (20,089), Netherlands (965), Portugal (2,696), Spain (15,090), Switzerland (1,039), and the United Kingdom (301). *Center for Research on the Epidemiology of Disasters Emergency Events Database*, <http://www.emdat.be/> (accessed 28 May 2008).

<sup>49</sup> Peter A. Stott et al., “Human Contribution to the European Heat Wave of 2003,” *Nature* 432, no. 2 (2 December 2004): 610–14.

change.”<sup>50</sup> A 2005 study by Kerry Emanuel finds rising sea surface temperatures (which are thought to be a result of anthropogenic climate change) are correlated with the increased severity of cyclones.<sup>51</sup> A 2006 paper by Michael Mann finds rising sea-surface temperatures are also correlated with the frequency of cyclones.<sup>52</sup> However, a 2006 study by Christopher Landsea et al. attributes findings of increased severity of hurricanes to better data estimation methods.<sup>53</sup> A 2006 World Meteorological Society consensus statement played down the possible connection, “The possibility that greenhouse gas induced global warming may have already caused a substantial increase in some tropical cyclone indices has been raised (e.g. Mann and Emanuel, 2006), but no consensus has been reached on this issue.”<sup>54</sup> That said, another 2006 study by Judith Curry et al. reviewed the evidence and concluded that only climate change can explain why there has been an increase in Category Four and Five hurricanes since the 1970s.<sup>55</sup>

The Working Group I contribution to the IPCC's 2007 Fourth Assessment Report reinforces this finding and concludes that there has “likely” been an increase in the intensity of tropical cyclone activity in some areas, namely the North Atlantic, since 1970 and that trend is also “likely” to continue.<sup>56</sup> The report also suggests, based on expert judgment rather than formal

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<sup>50</sup> Juliet Eilperin, “Scientists Disagree on Link Between Storms, Warming,” *Washington Post*, 20 August 2006. For an accessible overview, see Chris Mooney, *Storm World: Hurricanes, Politics, and the Battle Over Global Warming* (New York: Harcourt, 2007).

<sup>51</sup> Kerry Emanuel, “Increasing Destructiveness of Tropical Cyclones Over the Past 30 Years,” *Nature* 436, no. 7051 (4 August 2005): 686–88.

<sup>52</sup> Michael E. Mann, “Atlantic Hurricane Trends Linked to Climate Change,” *EOS* 87, no. 24 (13 June 2006): 233–44.

<sup>53</sup> Christopher W. Landsea et al., “Can We Detect Trends in Extreme Tropical Cyclones?” *Science* 313, no. 5786 (28 July 2006): 452–54. Similarly, Reid Basher and Sálvamo Briceño, in their assessment of disasters in Africa, argue that increased vulnerability to weather events and better reporting may account for the rise in death and damages rather than any significant change in the numbers of events. Reid Basher and Sálvamo Briceño, “Climate and Disaster Risk Reduction in Africa,” in *Climate Change and Africa*, ed. Pak Sum Low (Cambridge: Cambridge University Press, 2005), 269–81. For an overview of these debates, see <http://www.realclimate.org/index.php/archives/category/climate-science/hurricanes/>.

<sup>54</sup> World Meteorological Society (WMO), *Statement on Tropical Cyclones and Climate Change* (statement presented at International Workshop on Tropical Cyclones, IWTC-6, San Jose, Costa Rica, November 2006), [www.wmo.ch/pages/prog/arep/tmrp/documents/iwtc\\_statement.pdf](http://www.wmo.ch/pages/prog/arep/tmrp/documents/iwtc_statement.pdf) (accessed 21 February 2007).

<sup>55</sup> The proportion of Category Four and Five hurricanes increased by 100 percent between 1970 and 2004. Judith Curry et al., “Mixing Politics and Science in Testing the Hypothesis That Greenhouse Warming Is Causing a Global Increase in Hurricane Intensity,” *Bulletin of the American Meteorological Society* 87, no. 8 (August 2006): 1025–37.

<sup>56</sup> The report concluded there was no clear trend that the number of hurricanes have increased. See IPCC, “Summary for Policymakers,” *Climate Change 2007: The Physical Science Basis*, 8. In an updated study, Kerry Emanuel finds methodology that climate change may reduce the frequency but increase the intensity of hurricanes in some places. Kerry Emanuel, “Hurricanes and Global Warming: Results from Downscaling IPCC AR4 Simulations,” *Bulletin of the American Meteorological Society* 89, no. 3 (March 2008): 347–67. Knutson et al., using a different method, model the effects of twenty-first century warming on hurricane numbers and intensity. They project that the frequency of Atlantic hurricanes will decline this century, but the frequency of the strongest storms (and the associated rainfall) will increase, though some elements of the destructive potential of hurricanes may decline. Thomas Knutson et al., “Simulated Reduction in Atlantic Hurricane Frequency under Twenty-first-century Warming Conditions,” *Nature* (May 2008, advanced on-line publication).

attribution studies, that the human contribution to this observed trend was identified as “more likely than not.” It makes the same conclusions for other extreme weather events including heavy precipitation events, areas affected by droughts, heat waves, and the incidence of extreme high sea levels.<sup>57</sup>

Not all regions of the world will be equally vulnerable to climate change, but even rich countries may find their adaptive capacity taxed by climate change. A 2006 Columbia University report sought to rank order the climate vulnerability of one hundred countries based on each country’s exposure to climate change and adaptive capacity. Looking out to 2050 and 2100, it compares a number of emissions scenarios and temperature ranges and finds that poor countries in Africa and South America will be most vulnerable, with rich countries of the advanced industrialized world in Europe and North America least vulnerable. When looking at the potential impact of extreme events for a range of scenarios, however, the study finds that even North America and Europe will be “extremely vulnerable” as early as 2050.<sup>58</sup> Thus, unlike abrupt climate change and sea-level rise, the links between climate and extreme weather events, including but not limited to tropical cyclones, present a stronger case for what should worry policy makers.

This still begs the question of whether or not weather events such as Katrina represent a national security risk for the United States in terms of the criteria in Table 2. Unlike some smaller island nations, the United States is not at risk from some catastrophic weather event that would uniformly affect the whole country. As for the U.S. capital, extreme weather events are not unknown to Washington, D.C. Hurricane Isabel in 2003 led to flooding in nearby Alexandria, Virginia. A 1933 storm led to widespread flooding in the region, including Hains Point, only a few miles from the White House. Still, the capital is likely to be much less vulnerable than New Orleans due to that city’s peculiar dependence on ill-maintained levees.

The post-storm anarchy that affected New Orleans constituted a temporary challenge to the state’s monopoly over violence. At its peak, the number of soldiers mobilized in the aftermath of Katrina exceeded seventy thousand, including twenty-two thousand active duty and more than fifty thousand of the National Guard (about 10 percent of the total Guard strength), in what resembled one of the overseas humanitarian missions to which the military has grown accustomed.<sup>59</sup> In the 2006 Quadrennial Defense Review, the U.S.

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<sup>57</sup> The terms “likely” and “more likely than not” have specific meaning in terms of assigned probabilities, “likely” equal to greater than 66 percent with “more likely than not” equal to greater than 50 percent. IPCC, “Technical Summary,” *Climate Change 2007: The Physical Science Basis*, 23.

<sup>58</sup> Gary Yohe et al., “A Synthetic Assessment of the Global Distribution of Vulnerability to Climate Change from the IPCC Perspective that Reflects Exposure and Adaptive Capacity,” (Palisades, NY: CIESEN, Columbia University, 2006), <http://www.ciesin.columbia.edu/data/climate/> (accessed 16 April 2007).

<sup>59</sup> Congressional Research Service (CRS), *National Guard Personnel and Deployments: Fact Sheet* (Washington, DC: Library of Congress, 10 January 2007), <http://www.fas.org/sgp/crs/natsec/RS22451.pdf> (accessed 8 July 2007); Government Accountability Office, *Hurricane Katrina: Better Plans and Exercises*

Department of Defense recognized the reality that military assets would likely be called upon in the event of future domestic emergencies and would need to coordinate with other agencies.<sup>60</sup> Does mobilization of the military for disaster relief constitute a national security problem? To the extent the mobilization is large and lasts long enough to divert the country's forces and strategic establishment from external defense for an extended period, then yes. If climate change requires more frequent mobilization of the military for domestic disasters, then this could ostensibly take away from overseas missions.

In addition to producing humanitarian catastrophe and lawlessness, Katrina also posed a threat to the country's critical infrastructure, notably oil refineries but also electricity and the port of New Orleans. Prior to the 2005 hurricanes, the Gulf Coast supplied about 56 percent of domestic crude oil (nearly 20 percent of the country's total, including imports) and supplied 47 percent of the nation's refinery capacity. Katrina and Rita, by damaging platforms, import terminals, refineries, and the electric grid, led to the region's oil and gas supply being shut-in for an unprecedented length of time. Thirty percent of the country's refinery capacity was also affected in the immediate aftermath of the storms.<sup>61</sup> By year's end, the damage to refinery capacity resulted in a loss of 188 million barrels of refined product, about 5 percent of that year's total.<sup>62</sup>

Economist William Nordhaus ran a simulation of the potential GDP losses from the increased frequency and intensity of hurricanes. He projected that the average annual hurricane damages will increase by 0.06 percent of GDP (from 0.062 percent of GDP to 0.126 percent of GDP) due to the intensity effect of a CO<sub>2</sub>-equivalent doubling. Looking at the United States, he estimates that climate change will make a rare intense hurricane like Katrina more likely, a once in every twenty-eight years event with climate change and a once every eighty-six years without.<sup>63</sup>

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*Needed to Guide the Military's Response to Catastrophic Natural Disasters* (Washington, DC: GAO, May 2006), <http://www.gao.gov/new.items/d06643.pdf> (accessed 7 July 2007).

<sup>60</sup> U.S. Department of Defense, *Quadrennial Defense Review Report* (Washington, DC: DOD, 6 February 2006), <http://www.defenselink.mil/pubs/pdfs/QDR20060203.pdf> (accessed 8 July 2007).

<sup>61</sup> Paul J. Hibbard, U.S. *Energy Infrastructure Vulnerability: Lessons from the Gulf Coast Hurricanes* (Boston: Analysis Group, March 2006), [http://www.energycommission.org/files/contentFiles/Infrastructure%20Vulnerability%20Hibbard\\_44873b7081ec6.pdf](http://www.energycommission.org/files/contentFiles/Infrastructure%20Vulnerability%20Hibbard_44873b7081ec6.pdf) (accessed 1 February 2007).

<sup>62</sup> Kristi A. R. Darby, David E. Dismukes, and Seth E. Cureington, "Hurricane and Energy Infrastructure in the Gulf of Mexico: Impacts and Challenges" (paper presented at the Gulf Coast Association of Geological Societies 56th Annual Convention, Lafayette, Louisiana, 25–27 September 2006), [www.searchanddiscovery.net/documents/2006/06086gcags\\_sec\\_abs/images/abstract.darby.et.al.pdf](http://www.searchanddiscovery.net/documents/2006/06086gcags_sec_abs/images/abstract.darby.et.al.pdf) (accessed 1 February 2007); Minerals Management Service, *Hurricane Katrina/Hurricane Rita Evacuation and Production Shut-in Statistics Report as of Monday, June 19, 2006* (report prepared for U.S. Department of the Interior, 21 June 2006), <http://www.mms.gov/ooc/press/2006/press0621.htm> (accessed 1 February 2007).

<sup>63</sup> William Nordhaus, "The Economics of Hurricanes in the United States" (NBER working paper no. 12813, National Bureau of Economic Research, Cambridge, Massachusetts, December 2006), <http://www.nber.org/papers/w12813> (accessed 4 September 2007).

The estimated macroeconomic costs are modest and might ultimately be a minor blip in a \$13 trillion economy. However, concentrated damage to specific places, including large-scale loss of life, property, and infrastructure, would overshadow these more diffuse costs to the whole economy. Cities like New York and Tampa Bay are vulnerable to extreme weather events that could cause large-scale loss of life, extraordinary property damage and local, albeit temporary, challenges to civil order.<sup>64</sup> Based on past incidence, southern Florida had an 8.9 percent annual probability of being hit by a hurricane; over a fifty-year period, it has a 70 percent chance of being hit by an intense hurricane. Though historically less susceptible to hurricanes, the New York City area could be liable to extreme damage in the event of a hurricane. The probability of being hit by a hurricane annually is just 2.6 percent, but over a fifty-year period, the area has a 26 percent chance of being hit by an intense hurricane.<sup>65</sup> One study suggests that, in a worst-case scenario, a Category Three hurricane could create a surge of up to twenty-five feet at JFK Airport. Another NASA study concludes that if sea levels rise by 1.5 feet by 2050 and the city were hit by a Category Three hurricane, much of New York City would flood.<sup>66</sup> Like Katrina, hurricanes hitting these areas could necessitate periodic mobilization of the military for domestic humanitarian purposes.

Military installations themselves are also vulnerable. In 1992, Hurricane Andrew did such damage to Homestead Air Force Base in Florida that it never reopened. In 2004, damage from Ivan kept Pensacola Naval Air Station closed for almost a year.<sup>67</sup> U.S. Central Command, the control center for operations in Iraq, is based out of MacDill Air Force Base in Tampa, Florida, one of the most hurricane vulnerable locations in the country. Models suggest the base would be severely affected if a class three hurricane were to strike.<sup>68</sup>

Sustained lawlessness and humanitarian problems after a domestic hurricane incident pose national security problems to the extent that they contribute to larger legitimization challenges for the government. Not only did

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<sup>64</sup> The International Hurricane Research Center, "Hurricane Center Identifies 10 Most Hurricane Vulnerable Areas," *Insurance Journal*, 18 October 2006, <http://www.insurancejournal.com/news/national/2006/10/18/73391.htm> (accessed 8 July 2007); Vicki Lankarge, "Top 10 Worst Places for an Extreme Hurricane to Strike," *Insure.com*, 29 August 2002, <http://www.insure.com/articles/homeinsurance/hurricane-strike.html> (accessed 8 July 2007).

<sup>65</sup> The Tropical Meteorology Project, "Landfall Probability Table, 2007" (Fort Collins, CO: United States Landfalling Hurricane Probability Project, Colorado State University), <http://www.e-transit.org/hurricane/welcome.html> (accessed 26 July 2007).

<sup>66</sup> Rob Gutro, "NASA Looks at Sea Level Rise, Hurricane Risks to New York City," *NASA Web Portal*, 24 October 2006, [www.nasa.gov/mission\\_pages/hurricanes/archives/2006/sealevel\\_nyc.html](http://www.nasa.gov/mission_pages/hurricanes/archives/2006/sealevel_nyc.html) (accessed 16 April 2007).

<sup>67</sup> CNA Corporation, *National Security and the Threat of Climate Change* (Alexandria, VA: CNA Corporation, 16 April 2007), 37, <http://securityandclimate.cna.org/> (accessed 16 April 2007).

<sup>68</sup> Kevin Duffy, "Could Tampa be the Next New Orleans?" *Palm Beach Post.com*, 9 July 2006, [http://www.palmbeachpost.com/storm/content/state/epaper/2006/07/09/m1a.TAMPA\\_CANE\\_0709.html](http://www.palmbeachpost.com/storm/content/state/epaper/2006/07/09/m1a.TAMPA_CANE_0709.html) (accessed 16 April 2007).

the United States have its international image as a competent agent further shaken in the wake of Katrina, but its inadequate response created a large credibility gap that has hindered the government's relationship with the population affected by Katrina, particularly in the African-American community. In poorer, weaker countries, the ability for the central government to restore hierarchical control might be much more limited.

This situation may be especially true for some U.S. neighbors, particularly in the Caribbean, and therefore deepen incentives for people to flee to the United States.<sup>69</sup> Such an influx of refugees might be unlikely in the immediate aftermath of a storm, but citizens of low-competence and poor, island countries like Haiti and Cuba could find it increasingly desirable to emigrate. Much as Fidel Castro did during the 1980 Mariel boatlift when one hundred twenty-five thousand Cubans emigrated to the United States, governments of poor countries may actively start to use the strategic threat of migration if they feel rich countries are not responsive to climate change.<sup>70</sup> In an era already characterized by rising anti-immigration sentiment in both Europe and the United States, such a development could be polarizing. The military and Coast Guard would likely be called upon to detain refugees at sea and establish holding facilities like Guantánamo Bay which was used by the Clinton administration in the mid-1990s to house nearly fifty thousand Haitian and Cuban refugees. At the very least, the U.S. military might find it called upon to provide humanitarian relief as it did in 2004 in Haiti after devastating floods.

### Arctic Sea Ice Melt

At the interstice between domestic and extraterritorial effects of climate change on the United States is the likelihood that summer sea ice in the Arctic will be gone by the middle of the century. Among its many effects, the absence of summer sea ice would open up the Northern Sea route (north of Russia) and the Northwest Passage (through the Canadian archipelago) to shipping, at least for parts of the year. Both sea routes would be attractive for shipping as they would provide much shorter routes between Europe and Asia than the Panama Canal, more than four thousand nautical miles less in the case of the Northwest Passage. While the opening of shipping routes is one of the potential benefits of climate warming, the issue threatens to become caught up in interstate disputes over sovereign control over those

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<sup>69</sup> Based on past hurricane incidence, southern Haiti and western Cuba have a 10 percent chance while northern Haiti and eastern/central Cuba have a 5 percent annual chance of hurricanes. Roger A. Pielke, Jr. et al., "Hurricane Vulnerability in Latin America and the Caribbean: Normalized Damage and Loss Potentials," *Natural Hazards Review* 4, no. 3 (August 2003): 102.

<sup>70</sup> Kelly M. Greenhill, "Extortive Engineered Migration: Asymmetric Weapon of the Weak," *Conflict, Security and Development* 2, no. 3 (Winter 2002): 105–16.

waters. Canada already has asserted some contested legal claims to jurisdiction over the Northwest Passage as internal waters, whereas the United States has asserted the Passage constitutes international waters over which free passage should be permitted. During the Cold War, the United States, concerned about the mobility of its navy, supported designation of the Northwest Passage as an international strait. However, without a more restrictive control regime than is typical of international straits, ships (including submarines) could come through the Passage relatively unimpeded bearing clandestine cargo or allow Russian incursions in U.S. waters.<sup>71</sup> Another concern is contested control of the area's potential petroleum reserves that have heretofore been inaccessible.

In summer 2007, the Russians raised the stakes by laying claim to the North Pole and the resources underlying it, setting in motion a scramble by other national governments. Norway and Denmark quickly dispatched research missions to the area to assess their own claims to the waters.<sup>72</sup> Canada announced that it would build an Arctic military port and upgrade its aging fleet of icebreakers with the purchase of up to eight new Arctic patrol ships.<sup>73</sup> Because the United States has still failed to ratify the UN Law of the Sea Treaty, it may not be part of the body that will adjudicate the legitimacy of Russia's claims or those of other governments. With relations between the United States and Russia increasingly frayed, tensions over territorial waters could harken back to the kinds of border disputes that once led to interstate war.<sup>74</sup> These concerns may be manageable, but the almost inevitable disappearance of Arctic summer sea ice will demand sustained U.S. engagement in dealing with the effects.

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<sup>71</sup> Elizabeth Chalecki, "Climate Change in the Arctic and Its Implications for U.S. National Security" (paper presented at the annual meeting of the International Studies Association, Chicago, Illinois, 2007), <http://fletcher.tufts.edu/maritime/documents/ArcticSecurity.pdf> (accessed 8 July 2007). See also Scott G. Borgerson, "Arctic Meltdown: The Economic and Security Implications of Global Warming," *Foreign Affairs* 87, no. 2 (March/April 2008), <http://www.foreignaffairs.org/20080301faessay87206/scottg-borgerson/arctic-meltdown.html> (accessed 22 May 2008).

<sup>72</sup> The Law of the Sea Treaty permits Arctic nations—Russia, Canada, Norway, the United States and Denmark (via Greenland)—to claim two hundred nautical miles of territorial waters and file for more territory if they can demonstrate their continental shelves extend to the Arctic seabed.

<sup>73</sup> Associated Press, "Russia's Mission to Claim Arctic Sea Bed Set to Reach North Pole," *International Herald Tribune*, 31 July 2007, <http://www.iht.com/articles/ap/2007/08/01/europe/EU-GEN-Russia-Arctic-Grab.php> (accessed 4 September 2007); Ewan MacAskill, "Canada Uses Military Might in Arctic Scramble," *The Guardian*, 11 August 2007, <http://www.guardian.co.uk/world/2007/aug/11/oil.arctic> (accessed 4 September 2007).

<sup>74</sup> David Barber, Louis Fortier, and Michael Byers, "The Incredible Shrinking Ice," *Policy Options* (December 2005–January 2006), <http://www.irpp.org/po/archive/dec05/barber.pdf> (accessed 8 July 2007); Michael Byers, "Unfrozen Sea: Sailing the Northwest Passage," *Policy Options* (May 2007), <http://www.irpp.org/po/archive/may07/byers.pdf> (accessed 8 July 2007); Rob Huebert, "Climate Change and Canadian Sovereignty in the Northwest Passage," *Isuma* 2, no. 4 (Winter 2001).

## THE EXTRATERRITORIAL EFFECTS OF CLIMATE CHANGE ON U.S. STRATEGIC INTERESTS

In the second section of this paper, I identified a set of conditions that would make states or regions strategically significant, including the location of important U.S. assets, allies, sites of important transportation corridors, sources of raw materials, places where blowback could harm the United States, and the original home of diasporas. Combined with the stakes involved, I developed a typology of U.S. extraterritorial interests, ranging from strategic threat on the upper end to a minor concern on the lower.

In the third section, I evaluated four potential direct threats to the U.S. homeland. Both the effects of climate change on U.S. neighbors and Arctic ice melt are relevant to some of the extraterritorial criteria, diaspora politics in the case of the former and transportation corridors and raw materials for the latter. In this section, I evaluate four additional effects of climate change that could inspire extraterritorial concern, including (1) effects on U.S. assets overseas and the links between climate change and (2) violent conflict, (3) failed states, and (4) humanitarian disasters.

The Working Group II contribution to the IPCC's Fourth Assessment Report suggests drought conditions, extreme weather events, heat waves, and extreme precipitation events will worsen, particularly in developing countries that have the least capacity to deal with these effects.<sup>75</sup> Low-lying island countries are especially vulnerable to rising seas, storms, and contaminated groundwater that may eventually make some of them uninhabitable. In the Sahel and southern Africa, water stress due to drought may adversely affect the food supply, increasing the possibilities for famine and competition over water resources in a continent already characterized by severe resource constraints. In 2007, the U.N. Secretary General even invoked climate change as one of the background causes for the conflict in Darfur, Sudan.<sup>76</sup> Africa and Asia in particular will likely experience more events of extreme flooding in coastal areas and in the mega-deltas of rivers. Parts of Asia are also projected to experience considerable shortfalls in freshwater due to glacier melt in the Himalayas and more irregular and intense monsoon rains.<sup>77</sup> In regions

<sup>75</sup> See IPCC, "Summary for Policymakers," *Climate Change 2007: Impacts, Adaptation and Vulnerability*, <http://www.ipcc-wg2.org/> (accessed 20 May 2008).

<sup>76</sup> Droughts in the 1980s brought pastoralists and agriculturalists into conflict over grazing rights in Darfur. Most scientists would shy away from attributing a single incident to human-induced climate change, only that climate change would make events like this one more likely. Since the original drought dates back to the 1980s, it is unclear if anthropogenic climate change could be considered a contributing cause. See Ban Ki Moon, "A Climate Culprit in Darfur," *Washington Post*, 16 June 2007, [http://www.washingtonpost.com/wp-dyn/content/article/2007/06/15/AR2007061501857\\_pf.html](http://www.washingtonpost.com/wp-dyn/content/article/2007/06/15/AR2007061501857_pf.html). For a critical examination, see Alex de Waal, "Is Climate Change the Culprit for Darfur?" *SSRC Blogs*, 25 June 2007, <http://www.ssrc.org/blogs/darfur/2007/06/25/is-climate-change-the-culprit-for-darfur/> (accessed 8 July 2007).

<sup>77</sup> IPCC, *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability*.

characterized by past history of conflict, poverty, and weak governance, climate change may exacerbate local tensions over scarce resources.<sup>78</sup>

### Climate Change and U.S. Overseas Assets

The United States has overseas assets (embassies, consulates, and military installations) that may be vulnerable to climate change. Climate change could necessitate emergency evacuation of U.S. citizens or damage U.S. assets and operations. Some overseas assets are inherently more vulnerable or more strategically important. The U.S. embassy in Dhaka, Bangladesh, like the rest of the city, is inherently vulnerable to flooding. Bangladesh, though, is not as strategically significant as another vulnerable piece of real estate, Diego Garcia. The low-lying island military installation in the Indian Ocean is somewhat vulnerable to typhoons (though it has not been seriously threatened since the 1960s). Until late 2006 when most operations were relocated to Qatar, the United States had about one thousand military personnel on the atoll, which served as an important airbase for both refueling and for bombing runs to Afghanistan and Iraq. Given its prior use in the first Gulf War, Diego Garcia may again prove strategically important but increasingly vulnerable to climate change.<sup>79</sup>

Other U.S. bases may also be at risk. The Bush administration has announced plans for a military build-up in Guam to beef up regional counterterrorism capabilities and to hedge against Chinese expansionism. Eight thousand Marines are to be relocated from Okinawa by 2014, at a cost of \$10 billion, while the United States also has plans to upgrade its existing naval and air force facilities.<sup>80</sup> The United States may need to consider what risk climate change poses to Guam. U.S. facilities in Guam are susceptible to rising seas and storm surges that will likely be exacerbated by climate change. In 2002, Super Typhoon Pongsona hit Guam and caused \$700 million in damages.<sup>81</sup> A comprehensive assessment is beyond the scope of this paper, but this preliminary review suggests the United States has reason to be concerned about the effects of climate change on some of its overseas facilities.

### Violent Conflict

Climate change may make violent conflict more likely; some vulnerable places may be areas of strategic significance. The links between climate

<sup>78</sup> A German advisory council report on climate change, in addition to the CNA Corporation report, echoes these conclusions. WBGU, "Summary for Policymakers," *World in Transition: Climate Change as a Security Risk* (Germany Advisory Council on Global Change, 26 June 2007), [http://www.wbgu.de/wbgu.jg2007\\_kurz\\_engl.html](http://www.wbgu.de/wbgu.jg2007_kurz_engl.html) (accessed 8 July 2007).

<sup>79</sup> CNA Corporation, *National Security and the Threat of Climate Change*.

<sup>80</sup> Christian Caryl, "America's Unsinkable Fleet," *Newsweek*, 26 February 2007, <http://www.newsweek.com/id/68465> (accessed 4 September 2007).

<sup>81</sup> *Super Typhoon Pongsona December 8, 2002* (Silver Spring, MD: NOAA, U.S. Department of Commerce), [www.weather.gov/os/assessments/pdfs/Pongsona.pdf](http://www.weather.gov/os/assessments/pdfs/Pongsona.pdf) (accessed 4 September 2007).

change and violent conflict are part of the broader debate on the effects of environmental scarcity on the onset of civil wars and disturbances. International relations scholars have provided a number of causal explanations that can help predict the role of environmental factors in the onset of violent conflict. Colin Kahl believes that states with exclusive institutions and stark cleavages (what he calls “groupness”) are more likely to be vulnerable to environmental scarcity-related conflicts.<sup>82</sup> Homer-Dixon argues states that lack adaptive capacity are more likely to experience environmentally linked conflicts.<sup>83</sup> Both scholars, however, suggest environmental variables alone are not sufficient to cause violent conflict and whether or not conflict occurs ultimately depends on other socio-political factors. Thus, in addition to assessments of environmental vulnerability, any assessment of climate-related conflict should include political, demographic, and socio-economic measures such as wealth and state capacity.<sup>84</sup>

One specific mechanism invoked as a potential cause of climate-induced violent conflict is environmental refugees. Climate change, through discrete events like hurricanes, is likely to spur large numbers of people to move either between or within countries. The CNA Corporation report, for example, identifies the risk of refugees fleeing Bangladesh to India after intense storms.<sup>85</sup> More gradual processes such as persistent drought may also spur migration. Like the Hutu who fled to the Congo in the aftermath of the 1994 Rwandan genocide, refugees may cause conflict in recipient countries, either by eliciting a cross-border response from their former country or by clashing with locals. Idean Salehyan and Kristian Skrede Gleditsch find that countries experiencing an influx of refugees from neighboring states are significantly more likely to experience civil wars.<sup>86</sup> However, Nils Petter Gleditsch et al. caution that unlike political refugees, climate refugees may not be as prone to organized violence: “Purely environmental migrants... often do not have political agendas in their home region and they do not necessarily regard themselves as victims of persecution deserving justice.” Whether or not environmental migration turns violent depends on how local governments handle the in-flow of new arrivals.<sup>87</sup>

Another possible mechanism by which climate change may lead to conflict is through the effects of more variable rainfall, contributing to periodic

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<sup>82</sup> Kahl, *States, Scarcity, and Civil Strife*, 52-56.

<sup>83</sup> Homer-Dixon, *Environment, Scarcity, and Violence*.

<sup>84</sup> James Fearon and David Laitin, using wealth as a proxy for state capacity, find that richer countries are less likely to experience civil wars. With variation in state capacity between poor countries, wealth is likely a poor proxy. James Fearon and David D. Laitin, “Ethnicity, Insurgency, and Civil War,” *American Political Science Review* 97, no. 1 (February 2003): 75-90.

<sup>85</sup> The CNA Corporation, *National Security and the Threat of Climate Change*, 18.

<sup>86</sup> Idean Salehyan and Kristian Skrede Gleditsch, “Refugee Flows and the Spread of Civil War,” *International Organization* 60, no.2 (2006): 335-66.

<sup>87</sup> On climate-change induced migration as a plausible cause of interstate conflict, see Nils Petter Gleditsch et al., “Climate Change and Conflict.”

water scarcity, crop failure, and rising desperation. Recent studies have sought to get at the specific linkage between climate change and conflict by correlating variability in precipitation with the onset of conflict. Two studies—one by Levy et al. and another by Cullen Hendrix and Sarah Glaser—find that variable rainfall makes the onset of violent conflict more likely as economic conditions drive desperate men to take up arms.<sup>88</sup>

In addition to the potential for water variability-related conflict, natural disasters themselves may make violent conflict more probable. With climate change likely to intensify weather-related disasters, this finding is quite troubling. Early studies argued that disasters could help diminish civil conflicts by producing a rallying effect where former antagonists work together to resolve common problems.<sup>89</sup> Dawn Brancati, by contrast, suggests that only in rare circumstances will groups involved in conflict be so weak or so profoundly affected by a disaster that they will be less likely to fight on.<sup>90</sup> She argues that disasters foster competition between groups for basic resources—food, water, shelter, relief—thus enhancing the probability that conflict will occur. In a large-N study, she finds that earthquakes make violent conflicts more likely, particularly in poor countries with a history of conflict. Earthquakes also increase the likelihood of rebellions and, to a lesser extent, civil wars, especially in poor countries with a recent past history of conflict. Brancati believes these effects are generalizable to other kinds of natural disasters.<sup>91</sup> Philip Nel and Marjolein Righarts similarly find that disasters enhance the risk of violent civil conflict, particularly in countries with high levels of inequality, mixed regimes, and slow economic growth.<sup>92</sup>

Together, the impact of climate change on refugees, rainfall variability, and disasters bode ill for a number of developing countries, some of which will be strategically important to the United States.<sup>93</sup>

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<sup>88</sup> Cullen S. Hendrix and Sarah M. Glaser, "Trends and Triggers: Climate Change and Civil Conflict in Sub-Saharan Africa," *Journal of Political Geography* 26, no. 6 (August 2007): 695-715, Levy et al., "Freshwater Availability."

<sup>89</sup> For an exploration of these questions, see *Disaster Diplomacy*, <http://www.disasterdiplomacy.org/>

<sup>90</sup> This potentially explains the resolution of the Aceh conflict in Indonesia after the 2004 tsunami.

<sup>91</sup> Dawn Brancati, "Political Aftershocks: The Impact of Earthquakes on Intrastate Conflict," *Journal of Conflict Resolution* 51, no. 5 (2007): 715-43.

<sup>92</sup> Philip Nel and Marjolein Righarts, "Natural Disasters and the Risk of Violent Civil Conflict," *International Studies Quarterly* 52, no. 1 (2008): 159-85. Nel and Righarts argue that disasters increase grievances and incentives to grab scarce resources while simultaneously undermining state capacity to respond. They find a country that experiences a "rapid-onset" natural disaster like an earthquake or hurricane is 50 percent more likely to experience violent civil conflict than one that does not. However, climate-related disasters may be less likely than other rapid-onset disasters in making a country more conflict prone.

<sup>93</sup> For a skeptical assessment, see Idean Salehyan, "From Climate Change to Conflict? No Consensus Yet," *Journal of Peace Research* 45, no. 3 (2008): 315-26.

## Failed States

The CNA Corporation report involving retired generals makes a more far-reaching claim that climate change “will seriously exacerbate already marginal living standards in many Asian, African, and Middle Eastern nations, causing widespread political instability and the likelihood of failed states.”<sup>94</sup> Failed states are those where the central authority is unable to exercise control over its entire territory, lacks legitimacy, and cannot deliver public services. At the extreme, the central government may collapse, as in Somalia.<sup>95</sup> Failed states not only put large numbers of people at risk from natural hazards and the depredations of fellow citizens, but they also pose larger regional and international security issues from cross-border migration and by providing so-called “ungoverned spaces” where rebel groups and terrorists can situate themselves. With the ability of Osama Bin Laden to use Somalia as a base of operations and then Afghanistan, failed states have taken on more strategic significance. The concern about failed states in the Sahel, for example, has elevated countries like Mali from strategic non-entities in U.S. foreign policy to figuring into U.S. broader counterterrorism strategy and its plans for a new Africa Command.<sup>96</sup>

Could climate change potentially be implicated in the rise of failed states? In the mid 1990s, the U.S. government convened a group of academics for the State Failure Task Force (SFTF) and assigned them to review the causes of state failure. The group found that regime type, more than any other variable, was the strongest influence that could explain state failure. Partial democracies were found to be more than seven times more likely to fail than full democracies or autocracies. Several other factors were associated with doubling the odds of failure, including low levels of material well-being (as reflected by infant mortality rates), low trade openness, and the presence of major civil conflicts in two or more bordering states. Environmental factors—including deforestation and soil degradation—were not found to be significant, though they did indirectly affect infant mortality. Data quality for environmental variables, however, particularly for Africa, was often poor or unavailable.<sup>97</sup>

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<sup>94</sup> The CNA Corporation, *National Security and the Threat of Climate Change*, 6. For a similar assessment, see Kurt M. Campbell et al., *The Age of Consequences: The Foreign Policy and National Security Implications of Climate Change* (report for the Center for Strategic and International Studies and the Center for a New American Security, November 2007), [http://www.csis.org/media/csis/pubs/071105\\_ageofconsequences.pdf](http://www.csis.org/media/csis/pubs/071105_ageofconsequences.pdf) (accessed 27 May 2008).

<sup>95</sup> The Fund for Peace, “The Failed Index 2007,” *Foreign Policy* (July/August 2007), [http://www.foreignpolicy.com/story/cms.php?story\\_id=3865](http://www.foreignpolicy.com/story/cms.php?story_id=3865) (accessed July 2007).

<sup>96</sup> Letitia Lawson, “U.S. Africa Policy since the Cold War,” *Strategic Insights* 6, no. 1 (2007), <http://www.ccc.nps.navy.mil/si/2007/Jan/lawsonJan07.pdf> (accessed 8 July 2007).

<sup>97</sup> SFTF would later be renamed the Political Instability Task Force. Of the 137 cases of state failure between 1955 and 1998, 32 percent occurred in sub-Saharan Africa, 22 percent in the Near East, 19 percent in Europe and the former USSR, 14 percent in the Americas, and 13 percent in East Asia.

We tend to think of state failure as deeper and more enduring than mere civil conflict.<sup>98</sup> The SFTF definition, however, encompasses revolutionary wars, ethnic wars, genocides/politicides, and adverse regime transitions. The SFTF dataset thus likely includes many conflicts studied by Levy, Brancati, Salehyan and Gleditsch, and Hendrix and Glaser in the works referenced above. Those studies, with their newly collected data, all buttress the view that variables likely made worse by climate change—refugees, rainfall variability, and disasters—contribute to violent conflict. While structural factors make states more likely to fail, shocks may precipitate a government's actual inability to extend control over the entire range of the country's territory.<sup>99</sup> In this, the potential for extreme weather events made more likely by climate change could play a contributing role in precipitous declines in standards of living and, thus, an enhanced likelihood of conflict and state failure. A government's inadequate response to a natural disaster can undermine its legitimacy with its population. Moreover, the strategic use of relief aid to reward supporters, as Zimbabwe and Ethiopia demonstrated in 2002 and 2007 respectively, can also convert a weather event such as a drought into a source of grievance. Thus, extreme weather events in poor, partial democracies with a history of conflict ought to be of special concern. Among those states vulnerable to conflict and failure, there are likely to be some that are of strategic interest to the United States, including Indonesia (based on concern about blowback and possibly the Straits of Malacca), Nigeria (due to its natural resources), and, depending on one's assessment of the terrorist threat, countries in the Sahel.

### Humanitarian Disasters

Violent conflict and state failure are potentially worrisome consequences, but large-scale humanitarian tragedies from natural disasters may be a more direct consequence of climate change. An extreme weather event may put, in the absence of a wider civil conflict, large numbers of people at risk of death from thirst, starvation, or disease. As seen with Katrina and the 2008 cyclone that struck Myanmar, poor quality governance may make many disasters worse. Exclusive focus on the links between climate change and violence miss the fact that more people are affected by natural disasters than by armed conflict.<sup>100</sup> The U.S. military, not least because of its airlift capabilities, will likely be called upon to respond to an increased demand for humanitarian

<sup>98</sup> See Robert Rotberg, ed., *When States Fail* (Princeton: Princeton University Press, 2004), 5.

<sup>99</sup> Nicolas van de Walle, "The Economic Correlates of State Failure: Taxes, Foreign Aid, and Policies," in *When States Fail*, 94-116.

<sup>100</sup> Between 1990 and 1999, an estimated 188 million people per year were affected by natural disasters, six times more than the 31 million annually affected by armed conflict. The report defined "affected by natural disaster" as those people who for a time either lost their home, their animals, their crops, their livelihoods, or their health as a result of a natural disaster. See United Nations Inter-Agency

intervention in states that are unwilling or unable to protect their own citizens from harm.<sup>101</sup> Some of these countries are likely to be of strategic concern to the United States, either because humanitarian disasters could give rise to anti-Western terrorist or insurgent groups (Indonesia, the Sahel, possibly Bangladesh) or because such events could strike crucial nodes in the global economy (such as Shanghai) or sources of vital natural resources (such as Nigeria).

Climate change is expected to have a number of regional effects that may make these kinds of humanitarian tragedies more likely. For example, climate models generally show a shortened growing season and deterioration of food production across the Sahel and parts of southern Africa.<sup>102</sup> Storm surges, particularly in densely populated coastal cities in Asia, could lead to large-scale flooding, loss of life, and disruptions to critical infrastructure in major port cities like Shanghai. One study finds that a tenth of the world's population—634 million people—live in coastal areas that lie within zero and ten meters above sea level. Seventy-five percent of those live in Asia.<sup>103</sup> Bangladesh, for example, has 46 percent of its population located in low elevation areas, with many people living in areas less than five meters above sea level.<sup>104</sup>

Since the 1990s, there have been a number of instances of extreme weather events—acute and persistent droughts, floods, and hurricanes that were accompanied by calls for relief, including military intervention. Disaster relief has now become a normal capability of the U.S. military since the December 1992 deployment of nearly thirty thousand troops to Somalia in Operation Restore Hope. The American military was also dispatched to Central America after 1998's Hurricane Mitch and to Haiti in 2004 after torrential rains and mudslides.

While not related to climate change, the 2004 Asian tsunami, which killed more than two hundred thousand, reminded us of nature's terrible

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Secretariat of the International Strategy for Disaster Reduction (UN/ISDR), *Living with Risk: A Global Review of Disaster Reduction Initiatives, 2004* (Geneva: UN/ISDR, 2004), 45.

<sup>101</sup> Although vulnerability remains quite high, disaster responsiveness has improved markedly. In Africa, for example, reported deaths from disasters fell from 579,452 over 1983-92 to 43,078 over 1993-2002. Basher and Briceño, "Climate and Disaster Risk Reduction in Africa," 271.

<sup>102</sup> Climate models suggest the Horn will likely experience greater precipitation, but models are inconclusive for the Sahel. IPCC, "Regional Climate Projections"; UNFCCC, "Background Paper on Impacts, Vulnerability and Adaptation to Climate Change in Africa" (paper prepared for the African Workshop on Adaptation Implementation of Decision 1/CP.10 of the UNFCCC Convention, Accra, Ghana, 21-23 September 2006), [http://unfccc.int/files/adaptation/adverse\\_effects\\_and\\_response\\_measures\\_art\\_48/application/pdf/200609\\_background\\_african\\_wkshp.pdf](http://unfccc.int/files/adaptation/adverse_effects_and_response_measures_art_48/application/pdf/200609_background_african_wkshp.pdf) (accessed 8 July 2007).

<sup>103</sup> "Climate Change: Study Maps Those at Greatest Risk from Cyclones and Rising Seas" (press release, International Institute for Environment and Development, 28 March 2007), <http://www.iied.org/mediaroom/releases/070328coastal.html> (accessed 28 March 2007).

<sup>104</sup> Gordon McGranahan, Deborah Balk, and Bridget Anderson, "The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones," *Environment and Urbanization* 19, no. 1 (2007): 17-37.

power. The world community pledged more than \$6 billion in moral solidarity with those who suffered. More than fifteen thousand U.S. military personnel supported the relief operation that delivered 24.5 million pounds of relief equipment and supplies.<sup>105</sup> That response also provided an undesired and yet important strategic moment in the West's relationship with the Muslim world. Indonesia has a fragile government whose people could be another source of international terrorism should the state founder. The strategic aspects of the tsunami were not lost on then secretary of state Colin Powell who proclaimed, "...we believe it is in the best interest of those countries, and it's in our best interest. It dries up those pools of dissatisfaction that might give rise to terrorist activity..."<sup>106</sup>

Demands for humanitarian intervention will likely increase in a world of fragile states buffeted by climate change. Although some locations, like coastal cities, are geographically vulnerable to climate change, most natural disasters only have catastrophic consequences when accompanied by political and economic problems. A 2005 study concludes that the best predictors of a country's vulnerability to "hydro-meteorological disaster-related fatalities, homelessness, and livelihood disruptions" include a country's coastal exposure as well as the level of urbanization (more rural countries fared worse), the security of property rights, inequality, and income.<sup>107</sup> Poor, unequal countries with large rural or coastal populations and a large informal sector will be particularly vulnerable to such disasters.

Humanitarian intervention is part of a broader challenge to traditional notions of state sovereignty. Just as markets and firms now cater to customers' tastes, security is increasingly individualized as a right accorded to persons or small groups rather than purely to a collectivity. This understanding of security—implicit in the idea of democracy—was also embedded in the human rights regimes that emerged after World War II but got tied up by Cold War rivalries. With the Cold War conflict over, globalization of media and transportation facilitated greater transnational moral concern for human suffering. As interstate conflict has been superseded by intrastate violence as a major cause of intentional mass death, state sovereignty is no longer perceived as inviolate.<sup>108</sup> This has been underlined by the recognition that

<sup>105</sup> Jacquelyn S. Porth, *U.S. Military Tsunami Relief Mission in Asia Has Not Yet Peaked* (Washington, DC: Bureau of International Information Programs, U.S. Department of State, 2005), <http://www.globalsecurity.org/military/library/news/2005/01/mil-050114-usia05.htm> (accessed 1 February 2007).

<sup>106</sup> Colin Powell, quoted in, "Tsunami Disaster Spurs Massive Aid Effort," *News Hour Extra*, 5 January 2005, <http://www.pbs.org/newshour/extra/features/jan-june05/aid.1-05.html> (accessed 14 April 2007).

<sup>107</sup> The study's authors ascribe many of these effects to a country's colonial heritage and the extent to which the country is dependent on natural resources for exports. Bradley C. Parks and J. Timmons Roberts, *A Climate of Injustice* (Cambridge, MA: MIT Press, 2007).

<sup>108</sup> This was the most important outcome of the UN's High-level Panel. High-level Panel on Threats, Challenges and Change, *A More Secure World: Our Shared Responsibility* (report prepared for the United Nations, 2004), <http://www.un.org/secureworld/report3.pdf> (accessed 1 March 2007).

states possessing weapons of mass destruction or sheltering terrorist groups potentially forfeit the sovereign right to be left alone.<sup>109</sup>

Developing countries are wary that this concept will legitimate violations of their territorial integrity by stronger powers. Nonetheless, states are increasingly expected to refrain from exacting violence against their own citizens. For states that neglect their responsibility to protect their own citizens, military intervention may be justified, particularly when large numbers of individuals are at risk. While only haltingly enforced by the international community (witness Darfur), an obligation is increasingly expected of other states to prevent those calamities from unfolding, whether they be a product of natural disasters (tsunamis, droughts, floods), or deliberate acts by malign governments or sub-national players committing acts of genocide (Darfur, Rwanda), or ethnic cleansing (the Balkans).<sup>110</sup>

In 2006, Asia and Africa had the most number of active conflicts as well as the most number of refugees; Asia had the largest number of people affected by meteorological disasters while several African countries had the highest proportion of their populace affected by disasters.<sup>111</sup> Though concerns about terrorism and failed states have enhanced Africa's strategic significance, the continent's strategic importance pales in comparison to Asia. Climate change is likely to disproportionately affect these regions, but effects on Asian countries would more likely qualify as strategic threats, while crises in African countries would likely constitute moral challenges (see Table 5). That said, with the diffusion of the norm of the responsibility to protect at home and abroad, the United States may find that distant countries affected by climate change, despite strategic insignificance (Darfur perhaps), will have their problems elevated as a matter of geopolitical concern.

## POLICY IMPLICATIONS OF CLIMATE SECURITY CONNECTIONS

Although a detailed policy agenda is beyond the scope of this paper, some observations provide a preliminary point of departure.<sup>112</sup> Climate change

<sup>109</sup> Richard Haass, "Sovereignty: Existing Rights, Evolving Responsibilities" (presentation to the School of Foreign Service and the Mortara Center for International Studies, Georgetown University, Washington, D.C., 14 January 2003), <http://www.state.gov/s/p/rem/2003/16648.htm> (accessed 1 December 2006).

<sup>110</sup> International Commission on Intervention and State Sovereignty et al., *The Responsibility to Protect: Report of the International Commission on Intervention and State Sovereignty* (Ottawa: International Development Research Centre, 2001).

<sup>111</sup> Uppsala Conflict Data Program, Graphs, "Active Conflicts by Region" (Uppsala, Sweden: Uppsala Universitet, 2007), [http://www.pcr.uu.se/research/UCDP/graphs/reg\\_year89.gif](http://www.pcr.uu.se/research/UCDP/graphs/reg_year89.gif) (4 September 2007); UNHCR, *UNHCR Statistical Yearbook 2007*, <http://www.unhcr.org/statistics.html> (accessed 4 September 2007); Philippe Hoyois, Regina Below, Jean-Michel Scheuren, and Debarati Guha-Sapir, *Annual Disaster Statistical Review: Numbers and Trends 2006* (Brussels: Center for Research on the Epidemiology of Disasters, May 2007), <http://www.em-dat.net/documents/Annual%20Disaster%20Statistical%20Review%202006.pdf> (accessed 4 September 2007).

<sup>112</sup> For a more detailed exploration, see Joshua W. Busby, *Climate Change and National Security: An Agenda For Action* (special report prepared for the Council on Foreign Relations, 2007), [http://www.cfr.org/content/publications/attachments/ClimateChange\\_CSR32.pdf](http://www.cfr.org/content/publications/attachments/ClimateChange_CSR32.pdf) (accessed 22 May 2008).

likely poses a national security risk for the United States and its overseas interests, particularly from extreme weather events that may directly affect the U.S. homeland and countries of strategic concern. A first step toward being able to develop appropriate policy tools is a better understanding of the particular vulnerabilities of specific places, as envisioned in the National Intelligence Estimate (NIE).<sup>113</sup> Vulnerability is partly geographic and will require more work by the physical sciences to identify which places in the United States and abroad are and will be vulnerable to extreme weather events and other climate effects. Geography is only a part of vulnerability; cities and countries are made more vulnerable by dysfunctional political environments and social systems. An assessment of U.S. overseas interests and climate change would seek to identify where strategic concern, climate vulnerability, and political risk overlap. These are likely to be the locales with governments least able or willing to respond to their citizens' needs with the most potential negative spillovers on U.S. interests. Existing early warning systems that separately assess climate and political risk need to be linked to better serve policy makers.<sup>114</sup>

Even if there was a way to capture greenhouse gases cost-effectively or move to a carbon-free energy source tomorrow, some climate change is, at this point, inevitable. Adaptation and disaster risk reduction strategies should be the priority policy response for climate security concerns, as they are likely to be much less costly than relief and rebuilding.<sup>115</sup> One estimate from the U.S. Geological Survey and the World Bank suggests an investment of \$40 billion would have prevented losses of \$280 billion in the 1990s. The Chinese spent \$3.15 billion on flood control between 1960 and 2000 and averted estimated losses of some \$12 billion.<sup>116</sup> Roger Pielke calculates that adaptation measures (including building codes, emergency warning systems, evacuation strategies) have much more theoretical potential for reducing hurricane damage than strategies based on reducing greenhouse gas emissions.<sup>117</sup>

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<sup>113</sup> See note 1. The National Intelligence Council has drafted a National Intelligence Assessment (NIA) on the implications of climate change for U.S. national security. An NIA is like an NIE but is not regarded as rigorous or authoritative.

<sup>114</sup> Dennis Tänzler et al., *Climate Change and Conflict Prevention* (report prepared at the request of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin, Germany, 2002); Hans Gunter Brauch, "Mainstreaming Early Warning of Natural Disasters and Conflicts" (presentation at the Second International Conference on Early Warning, Bonn, Germany, 2003). The 2008 Levy et al. study provides a first cut of such an assessment. Marc A. Levy et al., "Assessment of Select Climate Change Impacts on U.S. National Security."

<sup>115</sup> These conclusions on adaptation and mitigation are supported by the U.K. government-sponsored *Stern Review on the Economics of Climate Change*. The review was led by the economist Nicholas Stern, former chief economist at the World Bank. HM Treasury, *The Stern Review on the Economics of Climate Change* (Cambridge: Cambridge University Press, 2006), [http://www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm) (accessed 8 July 2007).

<sup>116</sup> HM Treasury, *The Stern Review on the Economics of Climate Change*, 434.

<sup>117</sup> Pielke calculates, for a set of assumptions, that for a 10 percent reduction in greenhouse gas levels below projected 2050 levels, hurricane damages would only be reduced by 4.5 percent. Roger

Adaptation policies are desirable for another reason. Even if the consequences of climate change prove less severe than feared, disaster risk reduction, particularly in coastal areas, would be worth pursuing. Risk reduction policies at home and abroad could include coastal defenses, water conservation and catchment, improved building codes, investments in alternative food production, and evacuation and relocation strategies. Insurance support for rebuilding homes in flood plains and near vulnerable coasts ought to be curtailed. Clearance of mangroves, wetlands, and other natural coastal buffers ought to be severely limited. The United States would want to prioritize buttressing the adaptive capabilities of strategically located countries that lack sufficient resources to do so on their own.

*The Stern Review* to the U.K. government estimated that the additional resources required to insulate new infrastructure in the United States from climate risk would be on the order of \$5 billion to \$50 billion per year. For developing countries, the cost to minimize damage to new investments was estimated to be between \$4 and \$37 billion per a year. Of that total, between \$2 and \$7 billion should come from external finance to cover the portion of international investments vulnerable to climate change.<sup>118</sup> Since this estimate focuses on protecting new investments from damage and does not take into account poor countries' resource constraints, it likely understates the total external financial need developing countries will require.

The World Bank's Global Environment Facility (GEF) administers several adaptation-related funds, including the Special Climate Change Fund (SCCF) and the Least Developed Country Fund (LDCF). The total of each fund is quite low (they collectively have raised about \$260 million), which in part reflects the historically contested status of adaptation within climate politics.<sup>119</sup> Even as it has become increasingly clear that climate effects are already upon us,

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Pielke Jr., "Future Economic Damage from Tropical Cyclones: Sensitivities to Societal and Climate Changes," *Philosophical Transactions of the Royal Society* 365, no. 1860 (January 2007): 1-13, [http://sciencepolicy.colorado.edu/admin/publication\\_files/resource-2517-2007.14.pdf](http://sciencepolicy.colorado.edu/admin/publication_files/resource-2517-2007.14.pdf) (accessed 8 July 2007).

<sup>118</sup> HM Treasury, *The Stern Review*, 442. The United Nations Development Programme's 2007/2008 Human Development Report estimated that \$86 billion per year would be needed by 2015 for pro-poor adaptation. Of that \$86 billion, \$44 billion would be required to climate proof new investment, \$40 would be required for adapting poverty reduction strategies for climate change, and \$2 billion would be needed to additional disaster response. Watkins, Kevin Watkins, *Human Development Report 2007/2008* (New York: UNDP, 27 November 2007), <http://hdr.undp.org/en/reports/global/hdr2007-2008/> (accessed 20 July 2008).

<sup>119</sup> As of March 2008, for example, the LDCF had pledges totaling \$172.84 million and the SCCF had pledges of \$90.3 million. Another \$50 million was available for the Strategic Priority on Adaptation under the GEF Trust Fund. After the 2007 Bali climate negotiations, the GEF was designated to administer another adaptation fund to be financed with the proceeds from Clean Development Mechanism. GEF Council, *Status Report on the Climate Change Funds* (Washington, DC: Global Environmental Facility, 20 March 2008) [http://www.thegef.org/uploadedFiles/Documents/LDCFSCCF-Council\\_Documents/LDCFSCCF4-April.2008/LDCF.SCCF.4.Inf.2%20Trustee%20Status%20Report%2003.21.08.pdf](http://www.thegef.org/uploadedFiles/Documents/LDCFSCCF-Council_Documents/LDCFSCCF4-April.2008/LDCF.SCCF.4.Inf.2%20Trustee%20Status%20Report%2003.21.08.pdf) (accessed 20 July 2008). See also, GEF, "GEF Support for Adaptation to Climate Change," (flyer, the Global Environment Facility, Washington, D.C., November 2005), [http://www.gefweb.org/projects/focal\\_areas/climate/documents/GEF\\_Support\\_for\\_Adaptation\\_to\\_Climate\\_Change.pdf](http://www.gefweb.org/projects/focal_areas/climate/documents/GEF_Support_for_Adaptation_to_Climate_Change.pdf) (accessed 28 May 2008).

supporters of a more robust climate policy have been less than enthusiastic about adaptation, as it is interpreted as a sign of fatalism that emissions reductions are impossible. This view is changing, and more support for adaptation is likely.

Even if these efforts help many countries reduce their vulnerability, some crises will inevitably come to a head. In those instances, the United States and other rich governments would want to have sufficient lift capability and material to provide humanitarian supplies. Given, however, that the worst cases will often be in the midst of ongoing domestic turmoil and violence, those missions may rarely be ones of mere charity. As the century unfolds, perhaps the biggest challenge for the United States is the development of more state-building tools, both inside and outside the military.<sup>120</sup> The country's appetite for such exercises will be sorely challenged after U.S. involvement in Iraq.

The emphasis in these measures is on adapting to climate change and responding to its consequences. However, without a successful mitigation strategy to dramatically reduce greenhouse gas emissions over the long term and to capture and store carbon in the medium run, the consequences of climate change will exceed the adaptation capabilities of most countries. While specific mitigation proposals are largely beyond the purview of this article, the highest priority for the United States will be adequate pricing of carbon through a tax or a cap on emissions coupled with a trading scheme. If properly implemented, this will not only send an appropriate signal to the private sector to search for carbon-free alternatives, but it will remove the main political barrier preventing the emerging economies of China and India to adopt more aggressive climate policies of their own. If China and India are to reduce their rate of emissions growth, they will need to be rewarded with extensive incentives to adopt clean energy technology, including cleaner coal plants, renewables, and even nuclear power. Simultaneously restraining its own emissions will be a tall order for the United States, as any efforts to address climate change will ultimately be bound up with broader energy policies.

Failure, however, to engage on climate change may have consequences for America's standing in the world. The United States, as of 2007, was responsible for 29 percent of greenhouse gas emissions since 1850.<sup>121</sup> Climate change has long been recognized as disproportionately affecting developing countries, and the legacy of rich countries' responsibility for climate change was incorporated into the differentiated commitments in the Kyoto Protocol. As the consequences of climate change become manifest, poor countries are becoming more resentful and demanding compensation funds to help them

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<sup>120</sup> Francis Fukuyama, *State-Building: Governance and World Order in the 21st Century* (Ithaca: Cornell University Press, 2004).

<sup>121</sup> Western Europe was responsible for 27 percent and China only 8 percent. Andrew C. Revkin, "The Climate Divide; Wealth and Poverty, Drought and Flood: Reports From 4 Fronts In the War on Warming," *New York Times*, 3 April 2007.

adapt.<sup>122</sup> A United States that fails to respond could find itself further alienated from poor countries who will seek to link any nature-related catastrophe to climate change, valid or not.

If either humanitarian intervention or state failure becomes a more familiar scene on the international stage as a partial consequence of climate change, the United States and other Western nations may feel compelled to violate state sovereignty, if only to placate domestic pressure. Where publics in those countries prove hostile to an American presence, the costs of the intervention can dramatically rise. Thus, mercy missions may, as occurred in Somalia, quickly give rise to local opposition. In those circumstances, a more benign international reputation could allow the United States to conduct and support humanitarian operations with less local resistance. One potentially sobering outcome of the analysis developed in section two might be that much of sub-Saharan Africa (even with the risk of state failure and terrorist havens) may be one of low strategic importance for the United States. Interventions in those situations, therefore, would have to be justified on moral grounds, though politicians will be tempted to sell them as necessary for counterterrorism.

### WHY U.S. NATIONAL SECURITY?

This article demonstrates that a focus on climate change and U.S. national security is a valid subject of inquiry. This is not a universally held view. Homer-Dixon argues that it is “parochial” to focus solely on the United States. Indeed, the problems Homer-Dixon identifies in developing countries are important ones. Any article has to be bounded. While the framework of security concern developed here is applicable to other countries, the United States holds the world’s greatest military power and is the largest emitter of greenhouse gases. Therefore, the United States alone makes a substantively interesting case. As Levy notes, much of the environment and security literature ultimately asks for a “re-orientation” in U.S. policy. Levy argues that U.S. policy makers would want to know why reorienting policy is in their interest.<sup>123</sup> This article, aside from its academic merits, may also serve policy makers with a measured assessment of their interest in addressing climate change.

This discussion still begs the question: why link climate change and national security? Deudney cautions against the linkage, “If everything that

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<sup>122</sup> These views vary by country. In a January 2007 poll, more than 60 percent of publics in Latin America (Argentina, Brazil, Mexico, Chile) and Turkey expressed disapproval of U.S. climate policies. The percentages were much lower in China and India (35 percent and 23 percent), largely because a high percentage (more than 50 percent) answered “did not know.” World Public Opinion.org, “Global Views of the U.S.” (public opinion poll, Program on International Policy Attitudes (PIPA), University of Maryland), [http://www.worldpublicopinion.org/pipa/pdf/jan07/BBC\\_USRole\\_Jan07\\_quaire.pdf](http://www.worldpublicopinion.org/pipa/pdf/jan07/BBC_USRole_Jan07_quaire.pdf) (accessed 27 May 2008).

<sup>123</sup> Homer-Dixon and Levy, “Environment and Security,” 190, 195.

causes a decline in human well-being is labeled a 'security' threat, the term loses any analytical usefulness and become a loose synonym of 'bad.'<sup>124</sup> Security problems, in his view, imply specific institutional responses and ways of thinking that may be antithetical to environmental problem solving. By tying the issue to national security, advocates may generate a sense of urgency, but such crash programs are often more expensive, less well designed, and more repressive than policies developed in less haste. Writing in 1990, he suggested that environmental concerns could win politically without resorting to national security framing.<sup>125</sup> Security language may invoke militarized, nationalist responses, but it may also catalyze other institutional responses. Like the General Agreement on Tariffs and Trade, the Marshall Plan, the interstate highway system, and the space program, numerous initiatives may be bundled under the security umbrella. If indeed real national security implications of climate change exist, they are worth knowing.

The opposite approach, bundling everything under security, has its own problems. Many foreign policy professionals and academics understand security as it relates to existential threats and military means. Those elites are privileged voices in deciding what constitutes national security. While climate change poses some common risks to all of humanity, the principal unit of reference to them remains the nation-state. While all states are ostensibly part of the problem, a handful of large states are responsible for a disproportionate share. As a result, those claiming that climate change is a national security threat need to make the argument on terms that conventional security types find intelligible.

This article hews close to traditional definitions of national security while broadening the discussion of environmental security beyond scarcity and conflict through examination of the direct effects of climate change on the United States and the extraterritorial effects of climate change on American security interests. Some of the potential effects of climate change such as sea-level rise and abrupt climate change lack sufficient evidence in their immediacy to suggest a short- to medium-run national security risk for the United States. More evidence, however, supports the link between climate change and extreme weather events that are likely to have direct effects not only on the United States but also on strategically significant countries overseas. This article shows that the problem of climate and national security presents enough legitimate concerns that scholars and practitioners ought to take it seriously.

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<sup>124</sup> Deudney, "The Case Against Linking Environmental Degradation and National Security," 463-64.

<sup>125</sup> Deudney, "The Case Against Linking Environmental Degradation and National Security," 469.